ANTHONY RIMMINGTON

STALIN'S SECRET WEAPON

THE ORIGINS OF SOVIET BIOLOGICAL WARFARE

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ABOUT THE AUTHOR

Dr Anthony Rimmington completed this volume during his period of appointment as an honorary senior research fellow at the University of Birmingham's Centre for Russian, European and Eurasian Studies. He has published widely on the civil life sciences industry in Russia and the former Soviet Republics and is the author of *Technology and Transition: A Survey of Biotechnology in Russia, Ukraine and the Baltic States* (London and Westport: Pinter Publishers and Quorum Books, 1992).

Dr Rimmington has also written a series of journal articles and book chapters on the Soviet Union's offensive biological weapons programme, including the following: 'From Offence to Defence? Russia's Reform of Its Biological Weapons Complex and the Implications for Western Security', *The Journal of Slavic Military Studies*, 16, 1 (2003), pp. 1–43; 'The Soviet Union's Offensive Programme: The Implications for Contemporary Arms Control', in Wright, S. (ed.), *Biological Warfare and Disarmament: New Problems/New Perspectives*, Lanham: Rowman and Littlefield Publishers, 2002, pp. 103–50; 'Invisible Weapons of Mass Destruction: The Soviet Union's BW Programme and Its Implications for Contemporary Arms Control', *The Journal of Slavic Military Studies*, 13, 3 (September 2000), pp. 1–46; 'Konversion Sowjetischer BW-produktions-einrichtungen: Der fall *Biomedpreparat*, Stepnogorsk, Kasachstan', in Buder, E. (ed.), *Möglichkeiten und Grenzen der Konversion von B-Waffen-Einrichtungen*, Münster: Lit Verlag, 2000, pp. 245–62; 'Fragmentation and Proliferation? The Fate of the Soviet Union's Offensive Biological Weapons Programme', *Contemporary Security Policy*, 20, 1 (April 1999), pp. 86–110; 'Conversion of BW Facilities in Kazakhstan', in Geissler, E., Gazsó, L. and Buder, E. (eds), *Conversion of Former BTW Facilities*, NATO Science Series, London: Kluwer Academic Publishers, 1998, pp. 167–86; and 'From Military to Industrial Complex? The Conversion of Biological Weapons' Facilities in the Russian Federation', *Contemporary Security Policy*, 17, 1 (April 1996), pp. 80–112.

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INTRODUCTION

This study seeks to fill a significant gap in the scientific and military history of the Soviet Union and to provide a deeper understanding of the global development of biological weapons. There has been an enormous amount of material published on the Soviet offensive biological weapons (BW) programme of the 1970s–90s, culminating in the magisterial study completed by Milton Leitenberg and Raymond Zilinskas in 2012.[1] However, there has been scant attention paid to the origins of the USSR's BW activity during the 1920s–50s, which laid the foundations on which the later programme was based. The accounts that exist rely very heavily on German intelligence reports originating in the Second World War, which are intermittently reliable, and there has been little or no attempt to examine materials in the various Moscow archives or a range of newly available Russian-language secondary sources. In addition, there has been no comprehensive analysis published of a series of fourteen British Secret Intelligence Service (SIS) reports focusing on the early Soviet BW programme, which were issued between 1 October 1924 and 14 January 1927. Access to this array of newly available sources and materials allows a comprehensive re-evaluation to be made of Stalin's early BW effort and strongly suggests that the programme, with its network of dedicated facilities and proving grounds, may have been much more extensive than previously believed, easily outstripping that of the major Western powers.

The study of Stalin's military biological programme, initially developed as a response to, and extension of, biological sabotage programmes pursued by Germany in the First World War, can shed much light on how states in the modern era might initiate and progress clandestine BW programmes. It is notable that the early Soviet programme relied heavily upon the substantive scientific foundations put in place by imperial Russia, which, in the last three decades of its existence, had created an extensive and advanced network of civil bacteriological R&D and production facilities. During the 1920s and 1930s, Stalin made full use of the Soviet system of totalitarian government to brutally exploit this scientific base and redirect its endeavours to military objectives. Moreover, the work on this first generation of offensive biological weapons was often undertaken without full regard for safety—as witnessed by the human casualties associated with the early years of the programme.

A key feature of Stalin's aggressive pursuit of an ambitious offensive BW programme was the apparent ease with which the Soviet Union was able to circumvent its international treaty obligations. It was legally bound by the 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare—the Geneva Protocol. Even though the Soviet Union had acceded to the Geneva Protocol in 1928, Stalin continued to expand his military biological network and to embark upon a programme of large-scale open-air testing on Vozrozhdenie Island in the Aral Sea. Some of this military work was concealed within ostensibly civil organisations such as the RSFSR People's Commissariat of Public Health (RSFSR Narkomzdrav). The later Soviet leadership was to closely follow Stalin's example in their signing of the 1972 Biological and Toxin Weapons Convention alongside the initiation and pursuit of a vast offensive BW programme throughout the 1970s and 1980s. They were also to follow Stalin's example of partial concealment with key military work in genetic engineering being conducted within the Biopreparat complex, part of the Soviet civil microbiological industry. In addition, in both the early and later programmes, the state security services played a pivotal role in the concealment and management of BW research and production. It is readily apparent in the light of the past Soviet experience that a key weakness of the existing 1972 Biological and Toxin Weapons Convention is the lack of provision of any means to ensure the compliance of the nations that have signed and ratified it.

The present book sheds new light on the role of Stalin with regard to the management of the early Soviet offensive BW programme. His hand is everywhere to be seen, from the promotion of favoured scientific personnel to the political repression and, in some cases at least, execution of leading scientists. He can be largely credited with having greatly strengthened the USSR's preparedness for biological warfare. He is reported to have displayed intense interest in this class of weapons, and during an April 1934 meeting of the Politburo focused on offensive BW experiments, Stalin launched a barrage of questions. At the same meeting, he personally took the decision to combine 'All institutes working on the problems of bacteriological war … into a single powerful institute.' It was as a result of this decision that the Red Army's Military Scientific-Medical Institute absorbed microbiological scientists from other units and became the Soviet Union's primary facility for biological weapons research for decades to come.

The Soviet Union's biological warfare capabilities were then to be severely undermined by Stalin's launch of the mass repression dubbed the Great Terror. These centralised, planned operations of state terror reached their culmination in the winter of 1937 through to the autumn of 1938, when it is estimated that approximately three-quarters of a million Soviet citizens were subject to summary execution and more than a million others were imprisoned within the labour camps of the Gulag.[2] Staff at bacteriological laboratories and scientific institutes concerned with microbiology were specifically targeted by state directives, and this resulted in the effective decapitation of the leadership of the Red Army's BW programme. Among those arrested were Mikhail Nikolaevich Tukhachevsky, the chief moderniser of the Red Army and a major advocate for the USSR's development of chemical and biological weapons, and Yakov Moiseevich Fishman, responsible for the organisation of the country's offensive BW effort. Crucially, the repression led also to the arrest and execution of Ivan Mikhailovich Velikanov, a brilliant scientist leading Soviet work on biological weapons. The reasons for the military purges are not fully understood, although it has been speculated that Stalin and his intelligence advisers were seduced by a Nazi campaign of disinformation. Certainly, in the case of the Soviet military biological programme, the elimination at this critical juncture of the country's principal authorities in this area of warfare meant that the USSR was much less likely to be ready to defend itself against, or indeed deploy, biological warfare when conflict broke out with Germany. The Stalinist purges may indeed have been a critical factor in forestalling the integration of biological warfare into its military doctrine before the German invasion of the USSR.

The Soviet possession of a powerful military-biological complex appears to have played a major role in deterring the German use of chemical or biological weapons during the Second World War. Stalin himself recognised the importance of his BW arm. In April 1941, on the eve of war on the Eastern front, he had himself briefed on the country's preparations for biological warfare by one the most senior and loyal Red Army BW officers, Colonel Mikhail Mikhailovich Faibich. Stalin also personally intervened with regard to the evacuation eastwards of the Red Army's main BW facility. It was eventually relocated to an infectious diseases hospital in Kirov where, in February 1909, while a prisoner of the imperial authorities, Stalin himself had been admitted after falling ill with relapsing fever. By the summer of 1942, both the fate of the Soviet Union and that of the Third Reich hung precariously in the balance during the build-up to, and outcome of, the battle of Stalingrad. It was at this critical juncture that, if either side was going to break the 1925 Geneva Protocol that prohibited the use of gas and bacteriological warfare, to which they had both agreed to abide, then this was the most likely moment. German intelligence was fully aware that, despite the weakening of the biological warfare arm with the execution of Velikanov and other senior officers, Stalin continued to retain powerful capabilities in this area. Meanwhile, there was a strong misperception at this time, both in the Soviet Union and among its Western allies, that Germany had embarked upon an advanced biological warfare programme. The available evidence suggests that both sides in the conflict at this time believed their opponents were preparing for the use of biological warfare, and this may have acted as a decisive deterrent.

In the post-war period, it was Stalin, with his acute awareness of the increased international political leverage that accrued from the possession of weapons of mass destruction, who expanded the Red Army's BW network with the construction of two new facilities focused on viruses and toxins. As is the case with the US programme, know-how and expertise gleaned from captured BW experts from Japan may have been utilised in the new military biological institutes. In 1952, Stalin also took the decision to construct a major new base for offensive BW experiments on Vozrozhdenie Island in the Aral Sea. The Aral'sk-7 base, which housed a population of more than 1,000, was eventually built on the island in 1954 and can be viewed as constituting the final part of Stalin's military biological legacy.

Very little has been publicly revealed concerning the degree of success achieved by Stalin's network with regard to the creation of biological weapons. Much of what is currently known is based on intelligence reports that have been declassified and released by the UK and US authorities. British SIS reports generated during the period 1924–7 provide what appears to be an astonishing amount of detail concerning alleged Soviet research on plague. Semen Ivanovich Zlatogorov, based in Leningrad (present-day St Petersburg), is identified as the lead scientist working on this agent. Zlatogorov was at this time one of the world's leading authorities on pneumonic plague. He had been a key participant in Russian efforts to combat the October 1910 to February 1911 outbreak of pneumonic plague in Manchuria and undertook a series of experiments with the causative strain. In April 1911, he then attended the International Plague Conference, which was held in Shenyang (then named Mukden), where it quickly became apparent that he was one of the scientists present with the most direct experimental knowledge of the disease. It is in this context that the British SIS reports of his alleged subsequent participation in an offensive biological warfare programme make especially uncomfortable reading. Zlatogorov and his colleagues sought to develop strains of plague that remained viable when loaded into artillery shells, aerial bombs and other means of dispersal. Much of the work was undertaken at the so-called Plague Fort in Kronstadt, a facility originally created by the imperial authorities for the study of plague. By 1925, Zlatogorov and his team are reported to have developed a desiccated form of plague that could be held in storage for more than 100 days without any diminution in virulence. The British, however, could find no evidence that Zlatogorov had succeeded in developing a battlefield weapon based on pneumonic plague. Rather than load the agent into artillery shells where the plague strains rapidly lost their virulence, Zlatogorov instead focused on dissemination in specially designed umbrellas, binoculars and so on.[3] Even here, though, he met with difficulties, and in September 1926, SIS reported that 'The proposed distribution of the bacilli by means of various complicated appliances has been given up and they will be spread by means of ordinary glass ampullas distributed by persons immune.'[4]

The pivotal role of the pneumonic plague specialist Zlatogorov and his collaborators is not acknowledged in official accounts of Stalin's military biological programme. It appears conceivable that against the background of ongoing turmoil during the political purges there may have been a loss of institutional memory with regard to their participation in the top-secret and highly compartmentalised programme. Their sudden arrest by the security services in the winter of 1930 and spring of 1931 and death shortly thereafter meant they were unable to contribute any oral or written history of their activities. In the case of Velikanov, another lead scientist who was repressed and executed, he had the good fortune to have a son who doggedly, over very many years, pursued the Soviet authorities and forced them both to rehabilitate his father and restore him to his central place in the account of Stalin's programme. Efim Demikhovskii, another key player, also survived the purges and wrote-up an account of his part in the BW research effort. Zlatogorov, meanwhile, belonged to an earlier generation of scientists. It was to be another two decades after his demise before Stalin released his iron grip on the country. The original experimental records and related documentation is likely to have been seized and stored away in specialised secret archives. It may very well be the case that all institutional memory of this strand of the programme was lost. It is to be hoped that the resurfacing of the SIS accounts of the early Soviet BW programme and their description of the leading role of Zlatogorov may prompt Russian historians to re-examine the historical archives and to seek additional corroboration of the British and German secret intelligence reports.

The only other Western analysis to have been released comprises an authoritative report, 'The Soviet BW Programme', issued by the CIA in April 1961. Its authors appear to have no knowledge of the work conducted by Zlatogorov and colleagues in Leningrad during the 1920s. Rather, the report focuses on the Red Army's BW facility in Kirov (NIIEG), and its forbears. The authors argue that the work on vaccines published by NIIEG, especially that touching upon bacterial pathogens, could be used as a rough measure of progress in BW agent research. The report notes that, by 1946–7, four bacterial vaccines against anthrax (*Bacillus anthracis*), tularaemia (*Francisella tularensis*), brucellosis (*Brucella melitensis*) and plague (*Yersinia pestis*), and, by analogy, BW agents based on these pathogens, had successfully completed phases of screening, laboratory evaluation and process development, in preparation for the mass production of viable, dried preparations. The authors of the CIA report recognise that to have largely completed this work within a decade was an impressive accomplishment.[5] Their report concludes that the four diseases, namely plague, anthrax, tularaemia and brucellosis, emphasised in experiments undertaken by NIIEG, point to the:

> intensive Soviet development of their BW potential at NIIEG, a programme which probably culminated in a well-defined technology for large-scale production by the middle or late 1940s. The degree of success attained in capturing within the finished product essential BW agent properties of virulence and stability under conditions of dissemination is not known.[6]

As well as the focus on anthrax, tularaemia, plague and brucellosis, there is also strong evidence that Soviet military scientists at the time pursued a programme of research on *Clostridium botulinum*, especially with a view to measuring the potential of botulinum toxin for acts of sabotage.

Given the high-level of financial and manpower resources devoted to Stalin's biological warfare programme, one might reasonably anticipate that there may have been a significant public and veterinary health dividend for the USSR. Advances and discoveries in Soviet military microbiology would, for example, be expected to find applications in the civil pharmaceutical and vaccine industry. One of the major legacies that has been attributed to Stalin's BW programme concerns the work undertaken by his military biological scientists to lay the foundation for the creation of a modern antibiotics industry. The BW institute in Kirov is reported to have begun penicillin production in 1944 and the antibiotic was then shipped from this facility directly to hospitals at the front.[7] During the period 1944–5, a Kirov-based team of specialists in microbial fermentation and drying technology is reported to have provided assistance in the creation of civil facilities for penicillin production.[8] The military researchers were subsequently awarded the USSR State Prize for their work on the industrial production of penicillin. In 1947, the Soviet military also developed technology for the production of streptomycin, which found application in the control of a plague outbreak that had originated in China.[9] Stalin's military microbiological facility in Kirov may indeed have made a useful contribution to the development of the

Soviet antibiotics industry. In reality, however, the crucial input was the transfer of critical penicillin know-how and technology from the United Kingdom to the USSR. In an expedition subject to the highest levels of secrecy, the British scientists Howard Florey and Arthur Gordon Sanders arrived in Moscow in January 1944. They carried with them samples of mould as well as some of their best purified penicillin extract. As well as presenting samples of the dried mould and a wealth of scientific and technical documentation, the British scientists also spent many days teaching the Soviet scientists the principles of extraction. It was only after the visit of the specialists from England that the Soviet Union was able to develop large-scale antibiotics production, and during the wartime period itself only a few Red Army personnel were ever treated with penicillin.

Russian military publications point also to the success of Stalin's BW personnel with regard to the development of novel bacteriophage preparations. It was in fact against a backdrop of a failing wartime pharmaceutical industry, with shortages of sulpha drugs, soap, disinfectants and other essential drugs, that the Soviet military turned its focus to unconventional solutions. The Red Army's Kirov institute is reported to have eventually developed technology for the production of bacteriophage that were successfully utilised in the treatment of gas gangrene. However, these military efforts appear to have been eclipsed by the achievements of the leading civilian scientist, Zinaida Vissarionovna Ermol'eva. She succeeded in organising the production of cholera bacteriophage in a specially constructed underground laboratory in Stalingrad. Around 50,000 inhabitants and soldiers in the city are reported to have been treated in the laboratory every day. Ermol'eva's success in countering the threat of the cholera outbreak resulted in the award of the Order of Lenin in 1942 and the Stalin Prize in 1943.

The most significant public health impact of Stalin's BW programme undoubtedly concerns the development of a number of novel vaccine preparations against a range of highly pathogenic infectious diseases. One of the most notable achievements was the creation of a live spore STI vaccine, which in the post-war period played a crucial role in reducing the incidence of anthrax in livestock in Russia and the republics. A human *STI* vaccine was subsequently developed by the military team, and in 1951–2 this underwent a successful field trial in Moldova, involving vaccination of more than 140,000 individuals. More recently, another of the Stalin-era anthrax vaccine facilities, the Orel' Biofactory, has utilised this technology to produce a human combined STI-1+PA anthrax vaccine, which has been licensed in Russia.[10] There is undoubtedly a requirement for such preparations with the threat of natural anthrax outbreaks resulting from contact with animal burial grounds remaining ever-present. In July 2016, for example, a twelve-year-old boy died and seventy other persons were hospitalised in the remote Yamalo-Nenets Autonomous Okrug in Siberia following contact with an anthrax-infected reindeer herd.[11] Meanwhile, in another military programme in Kirov, a live attenuated tularaemia vaccine was developed, and in 1946 this was introduced for mass vaccination by the Soviet Union. Work was also successfully completed in Kirov on the development and production of a live plague vaccine with 8.5 million personnel in the Soviet Army being vaccinated during the Second World War. A significant impact was also made by Stalin's BW complex with regard to the development of a live brucellosis vaccine and preparations against botulinum toxin.

There is evidence to suggest that the Soviet Union's pursuit of a clandestine BW programme may also in some cases have placed a block on medical progress. A key example concerns military research during the mid-1920s on *Encephalitis lethargica* (EL), which has been documented in British secret intelligence reports. EL was a complex central nervous system (CNS) disorder presenting with pharyngitis followed by sleep disorder, basal ganglia signs (particularly parkinsonism) and neuropsychiatric sequelae, that appeared around the same time as the great influenza pandemic of 1918. During the period 1916–27, it is estimated that nearly five million people were affected by EL, of whom a third died in the acute stages. In October 2003, UK scientists published a paper on the aetiology of EL, detailing evidence of a rare form of streptococcus bacteria in their EL patients. The findings of these researchers suggested that a massive immune reaction to these bacteria resulted in the immune system attacking the nerve cells of the brain.[12] According to the British intelligence reports, one of the lead BW researchers, Semen Ivanovich Zlatogorov, had isolated a bacterial strain associated with EL as early as 1922. His findings never appear to have been published in any mainstream scientific journals, and the Soviet military at the time sought to exploit his knowledge in the development of offensive munitions and sabotage devices. Awareness of the EL bacteria was presumably lost when Zlatogorov, following his arrest by the United State Political Administration (OGPU), a forerunner of the KGB, died in hospital in March 1931.[13]

Knowledge of Stalin's historical BW network is crucial both to making sense of the vast offensive biological warfare programme launched by the Soviet Union in the 1970s and as a crucial aid to a full understanding of Russia's current biological defence programme. The three military institutes created by Stalin, together with the associated facilities on Vozrozhdenie Island in the Aral Sea, continued to have overall management control of the offensive BW programme launched in 1972. However, in addition to their own capabilities, they supervised the powerful Biopreparat network that was engaged in R&D focused on the use of genetic engineering for the weaponisation of bacterial and viral pathogens. As highlighted above, the BW work was undertaken clandestinely by Biopreparat, which was ostensibly a branch of the civilian microbiological industry.

Aside from the former open-air test site in Vozrozhdenie, the military biological network created by Stalin has now been fully absorbed by Russia and remains currently in place. It is described and analysed in meticulous detail in the new volume published in 2018 by Raymond Zilinskas and Philippe Mauger, *Biosecurity in Putin's Russia*.[14] The Shikhany proving ground, in existence since the 1920s, remains at the heart of Russia's network. It is the location of the Ministry of Defence's Order of the Red Banner of Labour 33 Central Scientific-Research Experimental Institute (33 TsNIII).[15] [16] The Russian authorities have declared the proving ground to be out of bounds to Western observers. On 30 June 1997, the city of Shikhany was transformed by an edict of the then president, Boris Yeltsin, into a Closed Administrative-Territorial Formation (Zakrytye Administrativno-Territorial'nye Obrazovaniya, ZATO). Under the terms of the new edict, travel to Shikhany was restricted, and special police, procuracy, and courts directly under Moscow's jurisdiction have been reinstalled in the city.[17] A decree issued by the Russian government in July 2001 confirmed that Shikhany retained its 'closed' status.[18] That there has been no subsequent reduction in security at the site was confirmed in November 2011 when a reporter from Radio Ekho Moskvy visited the town and during his report confirmed that it remained a ZATO. Entrance to the site was only possible with a pass and via three military cordons. He also noted that with regard to Shikhany and its 6,500 inhabitants, everything, one way or another, remained connected to the 33 TsNIII.[19]

The three military biological facilities created by Stalin at Kirov, Ekaterinburg and Sergiev Posad remain in full operation. Until April 2011, the Russian Ministry of Defence's military biological facilities had together formed the Federal State Establishment 48th Central Scientific-Research Institute (48 TsNII) with the headquarters based in Kirov. In that month, however, 48 TsNII was dissolved as a budget centre.[20] There then was a major reorganisation and shift in management to Shikhany, and the three facilities were reported in 2012 to form branches of the Russian Ministry of Defence's 33 TsNIII.[21]

One of the most interesting aspects of developments in Russia's current military biological network is the evidence of a sustained effort to revisit the Stalinist purges and to retrospectively give full recognition to the scientific achievements and personal sacrifices made by Ivan Mikhailovich Velikanov, the lead scientist for many years of Stalin's BW programme, who was executed in April 1938. In December 1993, the Russian Ministry of Defence's own publication, *The Military-Medical Journal*, included an article documenting the achievements of Velikanov and the longstanding efforts of his son to fully restore his reputation. This represented an important attempt by the Russian military to create a new institutional memory of the early Soviet BW programme, with Velikanov, one of the outstanding microbiologists of his generation, at the very heart of the new historical account. The reappraisal of Velikanov's career culminated in 2004 with this tribute made by R.N. Lukina, writing in an official volume published to mark the fiftieth anniversary of the Russian Ministry of Defence's Virology Centre:

> Ivan Mikhailovich Velikanov ranks among the outstanding microbiologists of the late 1930s–mid-1940s. Although I.M. Velikanov does not have a direct connection to the founding of the Virology Centre, it is impossible not to give credit to this wonderful scientist, who, being one of the pioneers of military microbiology, stood at the source of the foundation of the system of anti-epidemiological defence of both troops and the population.[22]

The current book attempts to present a more nuanced and balanced view of Velikanov. It is undoubtedly the case that he was a highly talented individual and that he secured for himself a whole raft of important civil and military appointments in the Soviet life sciences field. These ranged from high-ranking positions at the First Moscow State University and at the National Institute of Public Health's Institute of Microbiology, to his role as director of the Red Army's Biotechnical Institute, the Soviet Union's main BW facility. However, in his attempts to meet the demands of his military sponsors, he is known to have clashed repeatedly with his civilian colleagues. For example, in a desperate attempt to escape the clutches of the military, Stepan Vasil'evich Korshun, director of the I.I. Mechnikov Institute of Infectious Diseases in Moscow, forced Velikanov to relinquish his management position at his facility. There has been speculation that Velikanov himself may have subsequently been the driving force behind the arrest in the early 1930s of leading infectious disease specialists from institutes belonging to the People's Commissariat of Health and their transfer to his own BW facility. Korshun provides a damning pen portrait of Velikanov as 'a person giving out energy but extremely bound-up in intrigue and a careerist'.[23]

Before making any assessment of Velikanov's character, one must first strive to ensure that his life and actions are viewed against the background of an extremely volatile socio-political landscape where the smallest error of judgement might lead to arrest and execution. Velikanov appears to have been subject to intense surveillance by the Soviet secret police, especially after his briefings of Stalin and the political leadership on the country's BW programme had begun. Despite provoking antipathy among some of his scientific colleagues, he has also been awarded high praise from his contemporaries. The internationally renowned scientist Professor Mikhail Petrovich Chumakov, who was a leading Soviet virologist, states that 'Velikanov was an outstanding person among microbiologists … An excellent organiser, a capable scientist, always full of plans and schemes. He was able to choose a topic of the utmost importance to the country. I am convinced that he was a communist of principle and honesty.' There is also strong evidence that he was loved and respected by his immediate family. Even after her arrest and lengthy interrogation by the NKVD, Velikanov's wife, Zoya Ivanovna Mikhailova, refused to condemn him as an enemy of the people. Therefore, we should not rush to any hasty moral judgement with regard to Velikanov, and in the event that full access is granted by the Russian authorities to the requisite archives, then his life and career are surely worthy of further study.

1

ORIGINS

THE LAUNCH OF THE MOSCOW STRAND OF THE RED ARMY'S OFFENSIVE BIOLOGICAL WARFARE PROGRAMME

During the nearly three-decade period of Stalin's leadership (1924–53), two distinct, and what appear to be highly compartmentalised, components of the Soviet Union's offensive biological warfare programme are in evidence. The main strand was launched by the Red Army in Moscow in 1926 and is very well documented with numerous archival and secondary sources available. It is possible to closely chart the geographical locations associated with this programme as its main R&D activity shifts from Moscow to Vlasikha, in the suburbs of the Soviet capital, and then to Gorodomyla Island, before arriving at its final resting point in Kirov. There is in addition a second, earlier and much more ephemeral strand, which is based in Leningrad, the former imperial capital, and associated with an older generation of Soviet microbiologists. This strand appears to have been mainly concealed within the RSFSR People's Commissariat of Health and the Red Army's Military-Medical Academy. Our knowledge of the Leningrad strand of the BW programme is based on much less firm foundations and relies heavily, although certainly not entirely, upon a series of fourteen highly detailed reports issued by the British SIS between 1 October 1924 and

14 January 1927. There are in addition a clutch of German intelligence reports and some references to historical BW activity in Leningrad in a number of secondary sources. Russian official sources do not refer to this 'enigma' programme at all. The first part of the present book will therefore focus initially on the well-documented Moscow-based BW programme, with discussion of activity in Leningrad to follow.

The imperial legacy: The bacteriological revolution in tsarist Russia

Stalin's launch of the Soviet Union's biological weapons programme relied heavily upon the scientific foundations put in place by imperial Russia. Mortality rates from infectious diseases were staggeringly high in the late imperial period. The new discoveries of Robert Koch, Ilya Ilyich Mechnikov and Louis Pasteur therefore had enormous potential significance with the prospect of epidemics being prevented by vaccination and other methods of immunisation.[1] In the last three decades of its existence, the Russian government, supported by a growing cadre of epidemiologists and microbiologists, created an extensive and advanced network of civil bacteriological R&D and production facilities.

The origins of Russia's first bacteriological station can be traced back to 1885 when a guard's officer was bitten by a rabid horse in St Petersburg. The officer's regimental colonel was Prince Aleksandr Petrovich Ol'denburgskii (1844–1932), who is reported to have had a philanthropic interest in medicine. Ol'denburgskii provided the finance for his officer and an accompanying physician to visit Paris and receive treatment from Pasteur. The physician received instruction on how to manufacture the rabies vaccine and subsequently launched production in the veterinary compound belonging to the Life Guard's barracks in St Petersburg. In 1886, with support from Prince Ol'denburgskii, a small station was opened that was engaged in the manufacture of the new vaccine and also attracted physicians and veterinarians who wished to study other infectious diseases such as smallpox, glanders (*Burkholderia mallei*), relapsing fever and syphilis. This station formed the nucleus for the subsequent formation in 1890 of the Imperial Institute of Experimental Medicine. Again in 1886, Il'ya Il'ich Mechnikov, Nikolai Fedorovich Gamaleya and other leading Russian scientists organised the opening of the Odessa Bacteriological Station for the production of rabies vaccine. This is reported to have been the first such station in

Russia and only the second in the world.[2] This 'meant that there were two such stations functioning in Russia in 1886, a useful corrective to the view so often encountered that Imperial Russia was an unrelievedly backward society'.[3]

Russia also emerged as one of the leading countries with regard to the study and treatment of plague. As early as August 1899, a dedicated anti-plague facility was opened at Fort Aleksandr I, part of the Kronstadt defence complex situated 2 kilometres from the Western tip of Kotlin Island close to St Petersburg.[4] Some R170,000 provided by Prince Ol'denburgskii was spent on the conversion of the fort and procurement of new equipment for microbiological research.[5] In 1901, the facility was named the Imperial Institute of Experimental Medicine's Special Laboratory for the Production of Anti-Bubonic Plague Preparations in Fort Aleksandr I (Osobaya laboratoriya Imperatorskogo instituta eksperimental'noi meditsiny po zagotovleniyu protivobubonnochumnykh preparatov v forte 'Aleksandr I'). The laboratory was engaged in the large-scale production of vaccines against plague and other infectious diseases.

As well as creating this advanced R&D and production facility, Russia was also in possession of some of the world's leading scientists focused on plague. Two of the most prominent individuals were Daniil Kirillovich Zabolotny and Semen Ivanovich Zlatogorov. Both scientists participated in Russian efforts to combat the October 1910 to February 1911 outbreak of pneumonic plague in Manchuria. This was the worst recorded pneumonic plague outbreak in history. Of the more than 43,000 recorded plague cases, only one single survivor was identified.[6] In April 1911, Zlatogorov participated in the International Plague Conference held in Shenyang (then named Mukden) and was at that time revealed to be one of the scientists present with the most direct experimental knowledge of pneumonic plague.[7]

In the first two decades or so of the twentieth century, there was a rapid expansion of imperial Russia's bacteriological network. It expanded from eleven institutions in 1902 to nineteen in 1907 and thirty in 1917.[8] Some of the new facilities were supported by funds from the state treasury, including: the Plague Laboratory at Fort Aleksandr I (Kronstadt), the Bacteriological Laboratory of the Women's Medical Institute (St Petersburg), Moscow University's Bacteriological Institute, the Ivan Churin Tomsk Bacteriological Institute, and the Pasteur Station in Tiflis. Non-governmental sources of funding were also used. In 1887, for example, the Kharkov Medical Society established a Pasteur Institute and a bacteriological station that were subsequently reorganised as a bacteriological institute. Meanwhile, in 1894, the Society for Control of Contagious Diseases played a key role in the establishment of the Kiev Bacteriological Institute. Private means were also employed in the creation of the F.M. Blumenthal Chemical–Bacteriological Institute—the forerunner of the present-day N.F. Gamaleya Institute of Epidemiology and Microbiology—and the Dr Vlasievskii Institute ('Immunity') in Moscow and the Belonovsky, Maslakovets and Liberman Institute in St Petersburg. In 1911, Nikolai Fedorovich Gamaleya, an outstanding bacteriologist, used his own funds to found the St Petersburg Bacteriological Institute.[9] In addition, the regional governments (*zemstvos*) funded the construction of bacteriological laboratories at sites across Russia in Vilnius, Perm', Tambov, Ufa and so on. In the case of smallpox vaccine, for example, the Poltava *zemstvo* began the production of this preparation in 1885, followed by the Chernigov *zemstvo* in 1886 and the Kharkov and Kherson *zemstvos* in 1889.[10]

The Russian military also developed their own bacteriological capability in the late imperial period. In 1894, Professor Viktor Vasil'evich Pashutin, the then head of the Military Medical Academy (St Petersburg), is reported to have persuaded the War Ministry to authorise the organisation of a chair of bacteriology and the construction of an infectious diseases clinic. Sergei Sergeevich Botkin was appointed the first head of the new facility. Among the scientists attached to the academy at this time was Dr Gamaleya, a pioneer in microbiology and vaccine research, who in 1886 had worked in Pasteur's laboratory in France.[11]

There was therefore a substantive civil, and to a lesser extent military, base, comprising a large network of specialist bacteriological facilities, together with their associated scientific personnel, held in high repute both nationally and in some cases internationally, which was used as a platform by Stalin for the launch of the Soviet Union's offensive BW programme. During the 1920s and 1930s, Stalin made full use of the Soviet system of totalitarian government to brutally exploit this high-level scientific base and forcibly redirect leading civil scientists and their associated facilities to work for the Red Army on its highly secretive offensive BW research and development programme.

The trigger: Biological sabotage against Russia in the First World War

Stalin's BW programme, although unprecedented in scale and ambition, was not an isolated phenomenon. It can instead be viewed as a response to, and extension of, the biological sabotage programmes pursued during the First World War by Germany, which were directed against Russia, the United States and other allies. During the period 1915 to 1918, an ambitious covert BW effort, sharply focused on draft, cavalry and military livestock, was led by the German army's General Staff. It was mainly directed against neutral countries engaged in the supply of animals to the Allies and was later extended to the belligerents as well. Among the countries targeted were Romania, the United States, and probably Spain, Norway and Argentina. Bacterial cultures of both *Pseudomonas mallei*, the causative agent of glanders, and *Bacillus anthracis*, the causative agent of anthrax, were employed by German saboteurs. The General Staff appears to have considered that the use of these agents was not in breach of the 1907 Hague Convention since they were targeting military supplies rather than enemy soldiers. It is difficult to determine the results of the programme, but the German operatives appear to have regarded it as a success.[12]

Russia was also a target of German BW operations. A number of sources suggest that a German agent attempted unsuccessfully to spread plague in the human population in St Petersburg in 1915 and that a similar attempt in 1916 was also foiled.[13] Such uncorroborated reports appear to be part of a pattern of wider rumours of planned biological attacks circulating among the Allies at this time. In October 1917, for example, the British received intelligence from a French source 'that the enemy had inoculated a large number of rats with plague, and they intended to let them loose in the United Kingdom from submarines or aeroplanes'.[14] There is in fact no substantive evidence that Germany sought to use biological weapons against humans. In September 1916, Oberstabsarzt (captain and physician) Winter, a sanitation officer of the 21st army corps, had advocated the use of zeppelins to drop liquid cultures of plague bacilli on English ports. However, the German surgeon general responded that 'if we undertake this step we will no longer be worthy to exist as a nation', and attacks on humans are reported to have been ruled out by the Germans on both ethical and technical grounds.[15]

While the Germans refrained from attacks on human populations, they did launch a campaign of BW sabotage using anthrax against livestock in Russia. The attacks were led by Baron Otto Karl Robert von Rosen, who was born in 1884 in Solna, Sweden. He was a charismatic individual who had been a lieutenant in the Swedish army and had represented his country in various shooting competitions during the 1908 Summer Olympics in London.[16] In 1912, Baron von Rosen moved to Finland, which, as a Grand Duchy, then formed part of the Russian Empire. Here, at the outbreak of the First World War, he became embroiled in the movement for Finnish independence. In 1916, under the cover of his own trading company, covert links were established by von Rosen to the German General Staff. The latter provided him and his associates with explosives and sugar cubes containing tiny ampoules of anthrax bacilli.[17] These were shipped across the border to northern Finland where von Rosen and his guerrilla squad infiltrated remote Russian army garrisons and deposited the adulterated sugar cubes into feed troughs of horses and cattle.[18] Entries in von Rosen's diary refer to the supply of anthrax cultures to rebels throughout northern Finland.[19]

In the winter of 1917, the Norwegian police arrested von Rosen and two companions in the remote Norwegian town of Karasjok, close to the Finnish border.[20] The baron's luggage was searched, and the Norwegian authorities discovered several maps of Russia and Finland, explosives and a small biological arsenal consisting of bottles of curare, 'microbial cultures' and two boxes of sugar lumps. Von Rosen would only confirm to his captors that his expedition was aimed at supporting Finnish independence. Following upon von Rosen's deportation to Sweden, a thorough analysis was conducted of the captured equipment. Norwegian investigators discovered that one sugar lump was missing from each box and that each of the remaining lumps enclosed a tiny glass capillary tube, sealed at its tip, containing anthrax spores in a liquid medium. It is believed that the grinding of the sugar with its glass insert between the molar teeth of targeted animals is likely to have resulted in small lesions in the wall of the alimentary tract caused by the broken glass. This allowed the anthrax spores to gain access to the body and was likely to lead to a lethal infection.[21] Before being 'rediscovered', two of von Rosen's sugar lumps remained preserved for eight decades in a police museum in Trondheim, Norway. In 1997, they were sent from thence to the Defence Evaluation Research Agency, Chemical and Biological

Defence, in Porton Down, United Kingdom, where scientists were able to confirm that the capillary tube did indeed include *Bacillus anthracis* DNA.[22]

At the end of the war, the German General Staff intentionally destroyed the bulk of the documents relating to the programme of biological sabotage. However, in his study of the sabotage campaign, Robert Koenig concludes that the Berlin-based bacteriological laboratory belonging to the German Army's Military Veterinary Academy was the probable source of the glanders and anthrax cultures employed during the war. At the onset of the Great War, the academy was the only centre for glanders research in Germany, and it was also engaged in anthrax research and testing. It is notable that Professor Carl Troester, the Military Veterinary Academy's chief veterinarian, was a leading expert on glanders research. It appears to be no coincidence that three researchers based at the academy during the Great War subsequently played roles in German biological warfare research during the Second World War.[23]

In December 1918, in what appears to be a direct response to the German BW sabotage efforts against Russia during the First World War, the Revolutionary Military Council (Revvoensovet) issued Order No. 342, which established, under the Main Military-Medical Administration, a Provisional Scientific Committee focused on preventative measures against the infection of the human population with glanders.[24] Subsequently, on 8 December 1918, Revvoensovet issued Order No. 368 regarding the establishment of a Central Veterinary Bacteriological Laboratory (Tsentral'naya veterinarno-bakteriologicheskaya laboratoriya) under the Red Army's Main Military-Veterinary Administration.[25] The research programme pursued by the new facility appears to have closely resembled that which had been pursued at the military bacteriological laboratory in Berlin. The main role of the Moscow-based veterinary laboratory was concerned with the protection of the health of hundreds of thousands of horses in use by the Red Army. In this early period, the Central Veterinary Bacteriological Laboratory's research was primarily focused on glanders, but there were also programmes underway on anthrax and other infectious diseases.[26] This Soviet military veterinary programme is described in more detail in Chapter 8.

Besides the creation of its own military veterinary facility in Moscow, the German employment of biological warfare as a means of sabotage was also to play a critical role in kick-starting the Soviet Union's own wider offensive biological warfare programme. As Mark Wilkinson points out:

> The German programme was significant to the Soviet Union for several reasons. Firstly, it was the first time biological warfare had been used offensively in an organised way, secondly it was based upon scientific understanding and thirdly, it demonstrated how bacteria could be used covertly to alter the course of war. Perhaps more significantly, it appeared very difficult to either prevent or protect against the effects of a biological attack. For the Soviets, surrounded by nations perceived to be hostile to the communist cause, the potential therefore existed to create powerful weapons, through the application of science, against which there was little or no defence.[27]

A miniature chemical Napoleon or hero of the people? Yakov Moiseevich Fishman and the creation of the Red Army's Military-Chemical Directorate

The origins of the Soviet military biological programme are closely associated with Yakov Moiseevich Fishman. In August 1925, Fishman, then aged thirty-eight, was appointed the first head of the Red Army's Military-Chemical Directorate (Voenno-khimicheskoe upravlenie, abbreviated to VOKhIMU). As a key part of his activities, he then proceeded, methodically and with enormous energy, to organise and develop biological weapons research in the USSR and can rightly be proclaimed to be the principal architect of the Soviet Union's offensive biological warfare programme.

Before his appointment to VOKhIMU, Fishman had lived an extraordinary life encompassing revolutionary politics, political assassinations, exile to Siberia and monitoring military and chemical capabilities in Germany for Red Army intelligence. It is beyond the scope of the present book to provide a full biography of this extraordinary individual, but it is worth taking a brief look at his formative experiences. He was born on 11 April 1887 in Odessa, Ukraine. As a young political activist, in 1904 he became a member of the Socialist Revolutionary Party.[28] Fishman rapidly became caught-up in the political violence prevalent at that time. Sometime around 1906, it appears that Fishman was involved in a plot to assassinate Count Aleksei Ivanovich Konovnitsyn, the chairman of the Odessa Branch of the Union of Russian People (Soyuz Russkogo Naroda or SRN)—the most important of the organisations constituting the Black Hundred counter-revolutionary movement.[29] There appears to have been no hard evidence against Fishman, and he was subsequently released. He then travelled to Moscow where he was elected to the Moscow Committee of the Socialist Revolutionary Party. In 1908, while participating in the party conference, he was arrested for belonging to a terrorist organisation and sentenced to exile for five years in the remote Yenisei–Turukhan region, a fate subsequently shared by Iosif Vissarionovich Dzhugashvili, to become better known in later years as one Joseph Stalin.

The exile to the Yenisei–Turukhan region must have constituted one of the most formative periods of Fishman's life. According to Adam Bruno Ulam's biography of Stalin, it was the most dreaded location for penal settlement. Ulam paints a vivid picture of the conditions Fishman faced at this location, which occupied an incredibly vast, barren region in northern Siberia, twice the size of Texas, with a population consisting mainly of local tribesman and hunters together with other exiles and a few officials and traders. According to Ulam:

> Escape, while not impossible, was much harder than from any other area. Many who tried perished of cold, temperatures in winter going to less than -40°C., or of exhaustion, hundreds of miles often separating a settlement of four or five huts from another one. Former exiles could not decide what had been harder on their nerves—the long Arctic night of winter or the brief, damp, bug-infested summer with its 'white-nights' … even people who were physically well often broke down: suicides and cases of insanity were not infrequent … There was *one* doctor for the entire vast region; if you lived in a major settlement, i.e. one having ten or twenty houses, you might be visited by a feldsher (medical assistant) *once* a year.[30]

In the summer of 1911, Fishman is reported to have escaped his Siberian exile, first fleeing to China and then travelling on to Italy, where he lived until 1917. He enrolled in the Department of Chemistry at Naples University, and his contemporaries report that he obtained his doctorate at this time.[31] After the February 1917 Revolution, he returned to Russia. In the summer of 1917, he became a member of the Red Guard and the Petrograd Soviet of Workers' and Soldiers' Deputies. Later that year, in October, he participated in the iconic storming of the Winter

Palace, the seat of the Provisional Government located in Petrograd, then capital of Russia.[32] In 1920, he became a member of the All-Union Communist Party (Bolsheviks). Later, from 1921 to 1925, Fishman worked under the command of the Red Army's Intelligence Directorate, first in Italy and subsequently as a military attaché in Germany where his duties included the monitoring of chemical capabilities.[33]

As detailed above, in August 1925 Fishman was appointed the first head of the Red Army's Military-Chemical Directorate (VOKhIMU). Iosif Stanislavovich Unshlikht (transliterated variously as Jozef Unszlicht or Iosif Unschlicht), the deputy chairman of the Revolutionary Military Council, is reported to have selected Fishman for this position. As part of his new responsibilities, Fishman supervised the work of the Scientific-Technical Chemical Committee (Khimkom). This committee, whose chairman was the renowned chemist Vladimir Nikolaevich Ipatieff, was in charge of the production of poison gases for the Red Army.[34] Ipatieff, who succeeded in moving to the United States in the 1930s, provides the following penetrating portrait of Fishman in his memoirs:

> I observed very soon that co-operation with Fishman would not be easy. Without trying to understand the circumstances of the case, he began to criticize all former activities of the Chemical Committee. It was obvious that he wanted to impress the Revolutionary War Council and especially Unschlicht, who had appointed him, and to prove that in comparison with him, I had been practically inactive. His chemical education was below average, in spite of a Doctor of Philosophy degree in chemistry which he had received from an Italian university. He had been a Left Socialist-Revolutionist until the Bolshevik victory, and it was rumoured that he was somehow connected with the assassination of Mirbach, the German Ambassador. Galperin, who came to know him well, shared my opinion of this miniature chemical Napoleon.[35]

Fishman's abilities were not underestimated by his German counterparts. In 1928, a visiting German officer, who was participating in the joint Tomka Project in Shikhany, described him as 'having a burning ambition to build up a powerful Soviet CW capability, and to make gas a valuable weapon of war'.[36] Quite clearly, Fishman applied the same dedication to the development of Soviet BW capabilities. His lack of concern over the deaths of two female laboratory assistants working on the biological warfare programme, and his reported enthusiasm for the testing of chemical poisons and bacteriological weapons on prisoners, point to his willingness to go to any lengths to achieve his objectives.

Anthrax and the idée fixe: The launch of the Soviet Union's first biological weapons research programme

Fishman initiated the first Soviet military biological weapons research programme in 1926 at a small bacteriological laboratory controlled by VOKhIMU. The director of the laboratory was Dr A.N. Ginsburg, who appears to have been a specialist in chemical rather than biological warfare agents. He is not to be confused with Nikolai Nikolaevich Ginsburg, a little later to become a significant player in the offensive programme. By February 1928, a total of six personnel, including two assistants and one attendant, were employed within the laboratory. At this time, A.N. Ginsburg's facility was primarily focused on increasing the virulence and stability of anthrax (*Bacillus anthracis*) with the aid of special methods of growing cultures.[37]

The use of anthrax as an offensive agent was to remain the idée fixe of the Soviet BW programme for decades to come. During the Cold War, military work on the agent led to disaster. On Monday, 2 April 1979, an anthrax aerosol was released from the USSR Ministry of Defence's Scientific-Research Institute of Bacterial Vaccine Preparations, part of Military Compound Number 19 in Sverdlovsk. This incident led directly to the deaths of at least sixty-eight people in Sverdlovsk itself and to cases of animal anthrax in nearby villages (Rudnii, Bol'shoe Sedelnikovo, Maloe Sedelnikovo, Pervomaiskii, Kashino and Abramovo) to the south-east of the city. It was the first major indication in the West that the Soviet Union had embarked upon an offensive biological weapons effort. The anthrax programme reached its apogee in the 1970s and 1980s with Biopreparat's construction of the Stepnogorsk Scientific Experimental-Industrial Base (SNOPB). It incorporated capacity for the production of around 300 metric tonnes of weaponised *B. anthracis* spores per ten-month production cycle.[38]

Throughout the period 1926–8, Fishman prepared a series of progress reports for Unshlikht, deputy chairman of the Revolutionary Military Council, who had been given responsibility to oversee the chemical and biological programme. In March 1926, for example, he noted that tests with anthrax bacilli possessing enhanced virulence had been performed on small animals. The latter had died within twenty-two to twenty-four hours of exposure to spore-containing broth. In another report issued in mid-May, he detailed anthrax experiments on rabbits, cats and a horse. In his next handwritten report, he documented trials involving explosions in an armoured pit at a proving ground that demonstrated that anthrax could be loaded into artillery shells and aviation bombs. He also suggested that a special bacterial base might be constructed at the proving ground, with completion by the spring of 1927. In August 1926, Fishman outlined to Unshlikht the experiments that had been conducted on small animals and sheep, goats and horses, using a combination of both biological and chemical agents (mustard gas) in which the latter had facilitated penetration through the skin.[39]

On 12 November 1926, a summary of the work performed by the BW facility was provided in 'The Report on the Work Accomplished in 1926 by the Military Chemical Directorate Laboratory Under Dr A.N. Ginsburg'. The report detailed the orders that had been made for foreign equipment, a crucial requirement for the new programme. By May 1926, a stable and highly virulent strain of anthrax had been obtained, which, in its pulmonary and intestinal forms, resulted in 100 per cent mortality in animals and humans. The capability to store a dry form of botulinum toxin with a 'colossal killing capacity' had also been achieved.[40]

The key foundation stone: Fishman's 1928 report on BW to Kliment Efremovich Voroshilov

In February 1928, Fishman prepared a report for Kliment Efremovich Voroshilov (people's commissar for military and navy affairs and chairman of the Revolutionary Military Council of the USSR—the supreme military authority in the Soviet Union) on the Soviet Union's preparedness for biological warfare. The resulting document was of immense significance and was to underpin the Soviet effort in biological warfare for the next decade. It asserted that the 'bacterial option could be successfully used in war' and proposed a plan for the organisation of Soviet military bacteriology.[41]

Fishman outlined the experiments undertaken within A.N. Ginsburg's laboratory. The facility had:

> used a swabbed culture of anthrax from agar, which was either placed on the skin of an animal or atomised in the air in chambers containing animals. The experiments were conducted on rabbits, cats, goats and horses. In the overwhelming majority of tests death occurred on the second to third day. Several tests were also carried out into atomising this anthrax swab with the aid of detonating shells charged with an explosive substance. Animals remaining in the anthrax haze for two to three minutes died after forty-eight hours.

It was concluded that anthrax was a suitable candidate for use in biological weapons because its spores exhibited very high persistence, with any sickness ending in the majority of cases in death.[42]

Work was also carried out by Ginsburg on *Clostridium botulinum* with a view to measuring its potential for sabotage. It was found that 'infinitesimally small amounts of toxin obtained from these microbes, introduced with water or food into the gastro-intestinal tract—decline over the course of the next days'. It was concluded that toxins could be used for sabotage targets.[43]

Fishman went on to assert that

> Bacterial attack has to be wholly concentrated in the hands of the military leadership, in the Military-Chemical Directorate, in which special attention has to be allocated to two features: Maintaining absolute secrecy and prevention of accidents with experimenters, the population and domestic animals/livestock.
>
> Work on bacterial attack breaks down into three stages: Laboratory, Chamber and Field. A/. Our bacteriological laboratory has already complete equipment in the Institute for Chemical Warfare Defence. It is housed in a completely separate small house, not connected with the Institute's remaining building. Entrance to the Laboratory is forbidden to those not working in it. The Laboratory is called the Medical-Research Laboratory. At present six people work in it, including two laboratory assistants and one attendant. A further three qualified workers have been agreed on paper. All measures to protect workers against infection have been taken in the Laboratory. The laboratory is completely modernly equipped and/at least for a given period/satisfies requirements.
>
> B./ A chamber for the production of single detonation devices for artillery shells or bombs, charged with bacterial means—is absent. The explosive test chamber at the chemical proving ground for detonation

devices of shells with toxic agents has not been adapted for bacterial means. Construction of such a chamber with the corresponding services around it/vivarium, passage point etc/ is completely necessary and will provide the ability to study the possibility of military usage of bacterial means comparatively accurately and without risk to the workers. I propose that this chamber be expediently constructed on our Chemical proving ground having allocated a special section on it for this purpose. With full hermeticity of the chamber/and this could be achieved/and through disinfection after experiments, there would be no danger to the workers. Danger to the population or livestock would be even more completely prevented if the chamber could be located on a proving ground at least 1.5–2 *versts* [one *verst* is equal to 1.067 kilometres] from the nearest population centre and especially the fence. The actual proving ground is guarded and patrolled. The approximate cost of the chamber would be about 150,000 to 200,000 roubles.

B/. Open field tests of bacterial means require the finding of a special section corresponding to the aims of the experiments in a technical regard and guaranteeing secrecy and safety. The best of all would be to adapt some island sufficiently removed from populated areas to these aims. It seems to me that this island would have to satisfy the following conditions: surface—around 15–25 square kilometres, with a base line of 5 kilometres. The island has to be unpopulated and be about 10 *versts* removed from the shore. I think it is possible to find such an island in our waters. I asked T. MUKLEVICH to issue an order to search for an island meeting these requirements, obviously without saying what the island was required for. I suppose that the corresponding task ought also be given to the Military-Topographical Directorate. Possibly, some part of the deserted area located to the East of the Volga might turn out to be suitable. However, it seems to me that an island would be more suitable in view of it being easier to patrol. We could carry out all the first tests with non-pathogenic bacilli and thus establish danger zones. On the whole, means could be used in these field tests which are analogous to anthrax but which are not epidemic, such as plague. As regards the latter and analogous bacilli, special conditions and special equipment are necessary for its study even in the laboratory. At the present time, the Microbiological Institute in Saratov is working on plague. The Institute's experience could be studied by and used by us with the corresponding agreement with the People's Commissariat for Public Health.

> As a result of all these works—laboratory, chamber and field, types of bacterial shells and bacterial air bombs could be developed and also possibly special devices for infection which might be introduced into service.[44]

Fishman concluded that:

> 1. With correct handling the matters of secrecy and safety can be guaranteed.
> 2. 150–200,000 roubles must be allocated for the erection of a chamber at the chemical proving ground.
> 3. An instruction is necessary placing at the disposal of the Chief of the Military-Chemical Directorate, checked, qualified party members for the creation of a reliable basic cadre of staff in the military-bacterial business.
> 4. It is necessary to come to an understanding with the People's Commissar for Public Health about using existing bacterial institutes for the needs of military-bacterial matters and in general about the People's Commissariat of Health taking the corresponding preventative measures for when bacterial means are used against us.
> 5. It is necessary to give the task to the Military-Topographical Directorate of looking for a land area satisfying the following conditions: area from 15 to 25 square kilometres; presence of directrices at 5 kilometres; distance of area from nearest population centre—about 10–15 kilometres; and not too far from Moscow and ease of communications. An order has already been issued to find an island satisfying these technical requirements.[45]

Fishman's report and the accompanying recommendations were made against a background of genuine alarm within the Soviet leadership concerning the country's deteriorating international position and its lack of military and economic preparation for defence.[46] It constituted part of a wider effort at this time aimed at developing the Soviet Union's industrial capacity for the mass production of modern weapons and combat equipment. This culminated in Stalin's First Five Year Plan, which was inaugurated on 1 October 1928 and had the aim of creating 'an advanced scientific, technological and manufacturing base that could produce both capital goods and military goods, and thereby support successive generations of armament when the need arose'.[47]

The Institute of Chemical Defence's Ninth Department: The emergence of Efim Il'ich Demikhovskii as a key Soviet BW player

Fishman subsequently transferred A.N. Ginsburg's laboratory to the secret Red Army Institute of Chemical Defence (Institut khimicheskoi oborony imeni Osoaviakhima RKKA or IKhO) in Moscow. IKhO itself had only been created on 7 April 1928 and was directly subordinate to VOKhIMU. Fishman was appointed the first director of IKhO.[48] The bacteriological laboratory underwent several changes in name from Section VI (biochemistry) to Section N in 1929 and subsequently became known as the Ninth Department. Ivan Mikhailovich Velikanov, a brilliant young microbiologist, was initially placed in charge of IKhO's bacteriological facility. The creation of the Ninth Department is also closely linked to the emergence of Efim Il'ich Demikhovskii as a key player in Stalin's biological warfare archipelago. Demikhovskii was born on 10 May 1901 and graduated from the Ekaterinoslav Medical Institute (Dnepropetrovsk, Ukraine) in 1925. He then completed administrative-sanitary courses in Kharkov before being appointed as deputy director of the Crimean Pasteur Institute. At the end of 1929, Demikhovskii joined a small group from the institute that was sent to Moscow to attend a professional development course on bacteriology at the Central Bacteriological Institute. It was during this visit that Demikhovskii came to the attention of Zoya Ivanovna Mikhailova, wife of Ivan Mikhailovich Velikanov.

During one of Demikhovskii's visits to Velikanov's home, the latter suggested that he might like to join him in his work related to biological defence. Demikhovskii agreed to Velikanov's proposal, and within six weeks of submitting his application he had moved to Moscow with his family. The Demikhovskiis were housed in a dedicated hostel belonging to the Institute of Chemical Defence. Demikhovskii then began to work under Velikanov in the Ninth Department of IKhO. Within two months of his arrival, however, Velikanov had been removed from his position at IKhO following a decision by the Communist Party organisation within the institute. Officially, he was dismissed for 'moral dissolution' but the real reasons behind his removal are unclear.

After the departure of Velikanov, Demikhovskii was appointed as acting head of IKhO's Ninth Department. He was confirmed as director six months later. In his memoirs, Demikhovskii recalls that the secret Ninth Department employed twenty-four personnel including nine doctors, two senior laboratory assistants, six laboratory assistants and five nurses. The department was located in a separate two-storey building. All scientific work in this facility was confined to the eight rooms on the top floor. He reports that the lower floors contained the ancillary rooms, including a room with four large autoclaves, a room for the preparation of nutrient media, a room for the production of bacterial biomass and its pouring into artillery shells for field trials and a vivarium consisting of two rooms, one for live animals, and the other for infected animals where special protection of personnel was required.[49]

Demikhovskii reports that the secret facility pursued research in two main directions. In the first of these, Sergei Nikolaevich Muromtsev led a small group of bacteriologists in studies of the potential use of *Clostridium botulinum* 'to create serious disruption to enterprises producing food products, and measures to protect against such disruption'.[50] This work was overseen by Ivan Mikhailovich Velikanov. Muromtsev had graduated in 1923 from the First Moscow State University, and before joining the Ninth Department in 1928, he had worked for two years in the Moscow Oblast' Institute of Infectious Diseases. Muromtsev is later reported to have joined the NKVD as part of Grigorii Moiseevich Mairianovskii's Laboratory No. 1, where he employed a number of imprisoned scientists in a group working on bacterial toxins. Vadim Birstein reports that the aim of his research was to develop toxins for use by NKVD agents in assassinations. Muromtsev employed a number of imprisoned scientists, including Pavel Feliksovich Zdrodovskii and Lev Zilber.[51]

Muromtsev was later dismissed as head of the Ministry of State Security's laboratory in August 1951. He left the ministry's service at the same time, officially because of bad health. During the period 1956 to 1960, he was acting director of the USSR Academy of Medical Sciences' N.F. Gamaleya Institute of Epidemiology and Microbiology. Zdrodovskii, who had been abused by Muromtsev in his NKVD laboratory, left the institute in protest at the appointment. Even the Communist Party organisation within the institute raised objections to the appointment of a former head of a secret laboratory as director of an open, academic institution. There was also opposition within the USSR Academy of Medical Sciences, and the organisation refused to approve him as director. Muromtsev died on 14 December 1960 in Moscow. Such was his unpopularity within the Gamaleya Institute that not a single representative from the facility attended the funeral service.[52]

The second, and main, research programme pursued by Demikhovskii's Ninth Department involved a group headed by Nikolai Nikolaevich Ginsburg. Demikhovskii describes the latter as a 'talented young academic'. Ginsburg and his staff were studying the potential for the aerosol infection of animals with anthrax, plague and tularaemia (*Francisella tularensis*) bacteria. In order to reduce the danger posed by the research, the Soviet scientists substituted plague with tularaemia bacteria in their experiments. Using blueprints he had obtained from foreign literature, Ginsburg used a pump to create a bacterial aerosol of various concentrations in a hermetically sealed room. Guinea pigs were placed in metallic receptacles and exposed to the aerosols. Afterwards, they were enticed out of the room and returned to the vivarium via a small window. Throughout these procedures, Ginsburg and his researchers wore thick overalls, rubber gloves, rubber boots and gas masks. At the conclusion of an experiment, the room, along with the discarded protective clothing, was disinfected by steaming with formalin and windows were then left open for a number of days. Experiments were scheduled at a rate of two a week.[53]

Demikhovskii also records that he witnessed an experiment focused on infecting a horse with an aerosol of anthrax bacteria. For this purpose, Ginsburg and his team utilised a hermetically sealed cellar. The horse was tied up and then provided with food. A shell containing anthrax bacteria was then exploded. After one week, the remains of the horse were collected by the researchers and inspected for the presence of anthrax bacteria. In addition, dishes of nutrient media were placed at varying distances from the centre of the explosion and afterwards inspected for growth of anthrax colonies. According to Demikhovskii: 'In this way we determined the lethal concentration of the aerosolised pathogen.'[54]

The research supervised by Demikhovskii led directly to the deaths of two laboratory assistants, Konakova and Lobova; possibly the first human fatalities to have resulted from the Soviet offensive biological weapons programme. Their deaths were the result of an experiment commissioned by Fishman, head of the Military-Chemical Directorate. Fishman was convinced of the strategic value of employing a combination of chemical and biological agents. According to Demikhovskii, hundreds of doves, maintained in a wire cage in the Ninth Department's vivarium, were infected cutaneously with anthrax spores in a phenol solution. The dust thrown-up into the air by the flying doves is reported to have caused the laboratory assistants to become infected. Konakova, who fell ill ten days after her colleague, is reported to have stated that her illness 'would contribute to the defence of the socialist Motherland'. Demikhovskii reports that late in his life he still harboured feelings of guilt concerning the deaths of the two women. He notes that

> Fishman however, treated both deaths as something natural, considering them evidence of the effectiveness of bacteriological weapons and an argument for the necessity of their study. From unofficial conversations I subsequently found out about an agreement between Fishman and Stalin about the testing of chemical poisons and bacteriological weapons on prisoners.[55]

As a result of the failed experiment, Demikhovskii decided to use fowl cholera (*Pasteurella multocida*) bacteria, in place of anthrax and tularaemia bacteria, in field experiments that took place at IKhO's own proving ground in Moscow. Chickens were placed in cages that were arranged in a chessboard fashion across the test site. Artillery shells, which had been filled with chicken cholera bacteria, were then fired on to the proving ground. In his memoirs, Demikhovskii records that these experiments provided valuable information regarding the behaviours of bacterial aerosols in different atmospheric conditions. It was found, for example, that all other factors being equal, more animals died in damp conditions than in dry, sunny weather. The location of wide swathes of dead chickens was found to correspond to the wind direction prevailing during the trials. Demikhovskii and his colleagues used the data to hypothesise the behaviours of plague bacteria in similar prevailing conditions. They concluded that the use of artillery shells in battlefield conditions might result in a 'boomerang effect' and the infection of their own troops; instead, the plague bacteria would have to be dispersed in aerial bombs deep in the rear of enemy formations. However, the experiments undertaken with fowl cholera could not provide any information with regard to the survivability of plague bacteria when exploded in munitions.[56]

On 6 February 1933, Karl Yur'evich Yanel', the head of the Institute of Chemical Warfare Defence, issued an order forming five groups within Demikhovskii's department (now known as Department Nine). The heads of the groups were Nikolai Nikolaevich Ginsburg, Georgii Yul'evich Yaffe, Sergei Nikolaevich Muromtsev, E.N. Tolstukhina and

A.M. Yurkovskii.[57] Yaffe's inclusion in Stalin's early BW programme is interesting since he spent a period of ten years in North America. Yaffe was born to Jewish parents in 1890 in Lykovo, Belarus. During the period 1904 to 1907, he was a member of the Bund, a socialist opposition party formed in Vilnius in 1897 by Jewish workers and intellectuals. Yaffe travelled to North America in 1907 and for the next four years was a member of the Canadian Socialist Party. He then moved to the United States in 1911 and was a member of the US Socialist Party until 1917. Yaffe then returned to Russia and in 1917 became a member of the All-Union Communist Party (Bolsheviks). He went through higher education and graduated from the Institute of Red Professors. Before joining IKhO, he had been employed as the chief sanitary inspector of the People's Commissariat of Communications (railway, roads, canals etc.). He lived at this time in Moscow on Gagarinskii pereulok, building 16, no. 9. Demikhovskii had been introduced to Yaffe by Yanel' and they subsequently became friends and Demikhovskii visited Yaffe's house. The latter introduced him to a colleague from the Institute of Red Professors, Mekhlis. Demikhovskii remained as head of Department N when the Institute of Chemical Warfare Defence was renamed as the Red Army's Scientific-Research Chemical Institute (NIKhI RKKA).

The Soviet acquisition of tularaemia culture from the US Public Health Service

There is strong evidence that the tularaemia strains used in Ginsburg's BW experiments were originally supplied to the Soviet Union by the United States. The organism had first been isolated by George Walter McCoy of the US Public Health Service's Plague Laboratory in San Francisco and reported in 1912.[58] Both Soviet civil scientists and presumably their military counterparts appear to have been eager to gain access to McCoy's strains. On 13 November 1928, at a meeting of the Moscow Bacteriological Society, there was a discussion of tularaemia, which was viewed as presenting a great danger. Speaking at the meeting, Professor Il'ya L'vovovich Krichevskii, director of the Second Moscow University's Institute of Microbiology—who was also the former head of the Bacteriological Department of the Red Army's Military Sanitary Administration—explained that although he had tried very hard to secure cultures of the organism from American colleagues, he had not met with success. Heinrich (Heinz) Zeiss, a leading hygienist and head of the Microbiological Museum of Living Cultures at the Moscow-based L.A. Tarasevich Institute for Experimental Therapy and Vaccine and Sera Control (Institut eksperimental'noi terapii i kontrolya syvorok i vaktsin), noted that German bacteriologists had also been refused when making requests to obtain the cultures. He stated that the Pasteur Institute in France was also in possession of a culture but that this institute had also refused to give it away. Zeiss then criticised the reluctance of the Americans, which, according to him,

> is absolutely perspicacious because it obviously has to do with the preparation of a future 'bacteriological war', as an infection with tularaemia would cause a long-lasting illness, with relatively little mortality, and would therefore be more humane than gas. On the other hand, virulent cultures could only be dropped by bombers.[59]

Numerous incidents of a disease resembling tularaemia had been described in the Soviet Union throughout the 1920s, and these were most frequently linked to contact with water rats. In one of his articles dealing with the early incidence of tularaemia in the USSR, Zeiss notes that the disease was known among the local hunters under the name *khvor'* (the ailment). In the Soviet Union, the first and historically most important tularaemia outbreak was that observed by Sergei Vasil'evich Suvorov and colleagues in 1926 in the Astrakhan region, which involved around 200 persons. However, it was not until late 1929–30 that a definitive identification of the Soviet illness as tularaemia could be made. It was at this point that a Soviet researcher, G.I. Zarkhi, who had himself contracted the disease during his investigations, sent a specimen of his own serum, together with the preserved organs of infected guinea pigs, to McCoy in Washington. The latter confirmed that the tularaemia bacteria were present in both Zarkhi's serum specimen and the guinea pig organs and that they exhibited the typical features of the American strains of this organism.[60] Then, in late 1929, in what must have been viewed as an extraordinary stroke of good fortune for the Red Army's BW programme, McCoy dispatched the US tularaemia culture to Zarkhi's laboratory.[61]

Zeiss himself subsequently acquired the US tularaemia cultures for the Tarasevich Institute, but in 1930, after returning from a vacation, he found himself being accused by Mikhail Federovich Vladimiirskii, the Soviet commissar of public health, of carelessly leaving dangerous cultures in his laboratory without any supervision. On 27 September 1930, he met with Vladimiirskii and attempted to convince him that he was being smeared by rumours and speculation that he had provided information on tularaemia, supposedly for war purposes, to the German government. Zeiss argued that the organism existed in other countries and that there was nothing mysterious about it and nothing of military interest. He stressed that there was no point in the Soviet Union attempting to establish a tularaemia monopoly since the organism could be discovered in Germany or any other country in the event of an outbreak.[62]

Zeiss's protestations of innocence proved ineffective, and he now found himself being subjected to very close surveillance by OGPU. His desk was searched and his secretary was interrogated. On 28 November 1930, Vladimiirskii issued Order No. 1 relieving Zeiss of his position as head of the cultures collection at the Tarasevich Institute. The collection was subsequently transferred to another institution. Zeiss was informed that he was no longer allowed to work with living cultures in the Soviet Union. He concluded that he had been dismissed from his post because of the allegation that he had provided tularaemia culture to the German government for biological warfare research purposes. However, Soloman concludes that 'It is far more likely that the Russian authorities did not want a foreigner handling living cultures in Russia at the dawn of the era of biological warfare research.'[63]

Velikanov and the Soviet programme on Botulinum Toxin

Botulinum toxin (BTX) is the most acutely lethal toxin known to science. It is produced by the bacterium *Clostridium botulinum* and related species. Botulism is a relatively rare intoxication usually caused by ingestion of potent neurotoxins in contaminated foods. During the period 1920 through to 1939, the incidence of botulism in the Soviet civil population was very low, with 674 persons affected, of whom 173–6 died. The incidence of botulism in the Soviet Red Army from contaminated food was probably also relatively rare. There was therefore no pressing public health or military requirement to launch a major R&D programme aimed at the development of a botulinum toxoid vaccine.[64]

The lead Soviet expert on BTX and botulism was Ivan Mikhailovich Velikanov, who later emerged as the lead Soviet BW scientist. During the period from 1929 through to 1936, Velikanov established an extensive programme of prophylaxis and therapy of botulism poisoning. His most significant scientific research probably relates to his work on modifying the botulinum toxin to the nontoxic form of a toxoid. In 1934 and 1936, Velikanov reported the first experimental immunisation of human subjects with botulinum toxoids.[65] The serum he developed against botulism is reported to have saved the lives of many thousands of people. In 1935, Velikanov published *Mikrobiologiya konservov* (The microbiology of tinned goods).[66] His work was still being cited by Soviet authors in the 1960s.

There was almost certainly a military dimension to Velikanov's programme of research on botulism. In 1961, a CIA report on the Soviet BW programme noted that:

> Political refugees from the Soviet Union contend that botulinum toxin was one of the earliest candidates for agent development, chosen primarily because of its potential effectiveness by ground, air or water dispersion. Unconfirmed reports state that a purification process and suitable disseminating media were two major problems encountered in the preliminary investigations; by 1940–1941, studies on agent properties were allegedly in progress and the toxin was purportedly being stockpiled … [Velikanov] is said to have seen 227 cases of botulinum intoxication in humans, and his computations on comparative fatality rates among treated cases and untreated controls are one of the few hints of suspected human experimentation related to BW in the USSR.[67]

The report's careful use of language suggests that US analysts lacked firm evidence regarding Velikanov's role in human experimentation and one should be careful not to rush to judgement on the basis of a single unreferenced intelligence report.

As detailed above, Velikanov oversaw the BTX research being conducted by Muromtsev at the Institute of Chemical Defence's Ninth Department.[68] In 1929, Velikanov submitted a report on the BTX programme to both Fishman, the head of the Red Army's Military Chemical Directorate, and to the head of the Red Army's Military Sanitary Institute. This apparently indicated that a dramatic increase in the effectiveness of botulinum toxin had been achieved and it was estimated that the application of 1,000 litres would be sufficient to kill ten million guinea pigs.[69] On 15 April 1934, Velikanov gave a fifteen-minute presentation on his work on botulinum toxins to Stalin and other members of the Politburo. Velikanov's success with regard to his role in the BTX research appears to have led the military authorities to select him as the scientist to head-up the wider Soviet BW programme.

From small beginnings: the creation of the Vaccine-Sera Laboratory

Another major player with regard to the early Soviet biological warfare programme was the Red Army's Military-Sanitary Directorate (Voenno-sanitarnogo upravleniya or VSU). It was to be given responsibility for defensive preparedness against biological warfare. Lev Aleksandrovich Fedorov reports that in a joint report to VOKhIMU and VSU, Velikanov proposed the creation of a large facility for developing vaccines against putative biological weapons.[70] Eventually, after some considerable debate, a new facility, the Red Army's Vaccine-Sera Laboratory, was created in early 1930 in Vlasikha, close to the Perkhushkovo railway station, around 30 miles to the west of Moscow.[71] Buildings belonging to a smallpox institute, subordinate to the People's Commissariat of Public Health, were transferred to the facility.[72] The new military laboratory was subordinate to VSU.[73] Velikanov was appointed as head of the lab.[74] The construction immediately began of new living accommodation for personnel based at Vlasikha, who, initially at least, undertook a daily journey by train from Moscow to Perkhushkovo and then transferred by coach to the institute.[75]

There is only scant information available concerning the research underway at the Vaccine-Sera Laboratory. It is known that, in 1930, a researcher organised an expedition to one of the Volga regions in order to procure new strains of tularaemia. It was anticipated that novel strains would be isolated from muskrats that harbour the organism.[76]

In the spring of 1931, Mikhail Petrovich Chumakov accepted Velikanov's invitation to come and work at the Vlasikha laboratory. Together with his fellow student, I.A. Pavlyuchenko, Chumakov was engaged in research supervised by Velikanov on improving the laboratory diagnosis of gas gangrene in patients at the N.F. Sklifosovskii Institute (Moscow). The three scientists published a scientific article on this work. Chumakov later became recognised as the leading Soviet virologist of his generation. In 1950, he was appointed director of the USSR Academy of Medical Sciences' D.I. Ivanovskii Institute of Virology (Moscow). On his initiative, a new facility, the USSR Academy of Medical Sciences' Institute of Poliomyelitis and Viral Encephalitides, was formed and he served as director from 1955 to 1972. On 29 January 1960, he was elected as an academician of the USSR Academy of Medical Sciences' Department of Hygiene, Microbiology and Epidemiology. During the period 1960 to 1961, Chumakov managed a project that succeeded in launching the Soviet Union's first large-scale production of an inactivated cultural vaccine against the tick-borne encephalitis virus.[77] It is apparent from this example that Velikanov was recruiting some of the country's leading microbiologists to participate in his military programmes.

On 9 January 1933, the USSR Revolutionary Military Council issued Order No. 2 signed by Mikhail Nikolaevich Tukhachevsky, at that time an assistant in the People's Commissariat of Defence, to transform the Red Army's Vaccine-Sera Laboratory at Vlasikha into a new Military Scientific-Medical Institute (Voennyi nauchnyi meditsinskii institut RKKA). The facility was to remain subordinate to VSU, with a primary focus on the biological defence of both the army and the civil population.[78] The high-level importance attached to the facility at this time is demonstrated by the fact that Voroshilov, the people's commissar for defence, visited Vlasikha twice, and that his assistant Tukhachevsky travelled to the site no fewer than three times. Other high-level visitors included Army Commander Ieronim Petrovich Uborevich (commander of the Belorussian Military District) and Jānis Rudzutaks (deputy chairman of the Council of People's Commissars). In addition, both Mikhail Ivanovich Baranov (head of the Red Army's Military-Sanitary Directorate) and Fishman, head of the Red Army's Military-Chemical Directorate, were regular visitors to Velikanov's facility.[79] In November 1933, the Soviet newspaper *Izvestiya* published an article on the work of the new facility—another key indicator of the facility's growing importance at this time.

2

THE CREATION OF A BW PRISON LABORATORY

THE BACTERIOLOGICAL CONVENT

The next phase of expansion of the Soviet BW programme took place at a time of growing mutual suspicion between the USSR and Germany. A key event that may have been pivotal in subsequent Soviet decision-making was the receipt in 1930 by Voroshilov, people's commissar for military and navy affairs and chairman of the Revolutionary Military Council of the USSR, of an intelligence report that claimed that Germany was pursuing the development of bacterial weapons. It noted that: 'The work on utilization of bacterial material performed in Germany is in the stage of field testing ... The next method of utilizing bacteria is to employ shells ... Field experiments with those shells conducted in 1930 were a success. Experiments were made ...with anthrax spores and glanders bacteria.'[1]

Soviet concerns over the German programme appear to have been given voice in September 1930 in the *Krasnaya Zvezda* (Red Star) military daily newspaper, which reported that 'bourgeois armies ... are not far from being able to use one or another type of bacteria for destroying the enemy'.[2]

The creation of a BW sharashka: the Special Purpose Bureau at Suzdal's Convent of the Intercession

It is perhaps fitting that the Soviet Union's most secret BW facility was created at a site itself inextricably linked to ancient Russian myths and legends. For in the middle of the fourteenth century, so the story goes, Prince Andrei Konstantinovich was sailing down the Volga River from Nizhny Novgorod to Suzdal, when there was a violent storm. It was in the midst of this life-threatening event that the prince reportedly made a vow that, if he survived, he would found a convent as a means of giving thanks to God. Thus it was that, in 1364, Prince Andrei founded the Convent of the Intercession on the banks of the river Kamenka in Suzdal (Vladimir oblast').[3] It soon became a convenient place for Russia's leaders to exile their unwanted wives. In 1570, for example, Tsarevich Ivan, son of Ivan the Terrible, was encouraged to abandon his childless wife, Alexandra Saburova, within the confines of the convent. A second princess, Praskovya Petrovna-Solovaya, followed her into the religious institution shortly thereafter.[4] The most recent example concerns Eudoxia Lopukhina, wife of Peter the Great. Following their divorce in 1608, she was likewise banished to the Suzdal convent. Lopukhina was subsequently forced to take the veil as Sister Helena and remained at the site as a prisoner for twenty years, with visits only permissible by a small circle of friends.[5]

Following the October Revolution of 1917 and the creation of the USSR, there was a sustained anti-religious campaign by the new Soviet authorities. During the first five years of Soviet power, twenty-eight Russian Orthodox bishops and more than 1,200 Russian Orthodox priests were executed, with many others imprisoned or exiled. It was against this background that, in February 1923, the Soviet government closed down the Convent of the Intercession and the 100 remaining nuns were forced to evacuate the site.[6]

In July 1931, the OGPU seized complete control of the territory of the convent.[7] In the following year, OGPU created a facility known as the Bureau of Special Purpose (Byuro osobogo naznacheniya) of the Special Section of the United State Political Organisation—abbreviated simply to BON-OO-OGPU. BON was in fact a special prison laboratory, or *sharashka*, where around nineteen leading plague and tularaemia specialists were arrested and imprisoned by the OGPU and forced to work on the development of offensive and defensive biological weapons.[8] The creation of the Suzdal' BW *sharashka* was part of a much wider process whereby the Soviet security organs tightened their grip over the defence industry and the development of new weapons and military-related production processes. Other prison design and engineering bureaus and scientific complexes, for example, held the country's most prominent atomic physicists and the leading scientists from the aerospace industry, and there is also evidence to suggest that a *sharashka* was established in the pre-war years for the development of chemical weapons.[9]

A number of factors appear to have influenced OGPU in its choice of site for the BW *sharashka*. Despite lying just 130 miles north-east of Moscow, Suzdal is relatively isolated and is sited some 20 miles north of the Moscow–Nizhny Novgorod railway. In addition, the convent itself embraced an impressive outer perimeter wall, making unauthorised access extremely difficult (see fig. 3). The *sharashka* was located in close proximity to the Suzdal Camp of Special Purpose at St Euthymius Monastery of the Saviour where political prisoners had been held since February 1923.[10]

The director of the Suzdal Museum since 1931, Alexei Dmitrievich Varganov, made the following entry to his work log regarding OGPU's activities at the Convent of the Intercession:

> [In the summer of 1931, the Pokrovsky] nunnery was transferred to the authority of the United State Political Organization isolation ward for political prisoners, which carried out a complete overhaul of all structures. The nunnery was closed to all outsiders … In 1932, an organization called the Special Purpose Bureau of the Special Section of the United State Political Organization appeared at the nunnery. Museum workers who guarded the monuments were for a long time prohibited from inspecting them with the exception of the cathedral and the vestry … The nunnery premises were adapted for the needs of the Special Purpose Bureau … The state of the nunnery was exemplary, with everything having been glazed, repaired and whitewashed.[11]

Little has been published concerning the first director of BON, Colonel Mikhail Mikhailovich Faibich. He is described by Fedorov as a high-ranking military officer who specialised in typhus.[12] It is known that in 1928 he worked in Minsk at the Order of the Red Banner Belorussian Military District's Chemical-Bacteriological Laboratory. The head of the laboratory at this time was Petr Aleksandrovich Alisov, who later was promoted to major-general and headed-up the S.M. Kirov Military-Medical Academy's Department of Infectious Diseases (Leningrad).[13] After his posting in Suzdal, Faibich went on to have a highly successful career within the Soviet military BW network. He was clearly a highly influential figure since he is recorded as having met Stalin in April 1941. Later, in 1948, together with a group of military scientists based in Kirov, he was awarded the Stalin Prize (Third Degree) for the development and introduction into industry of new methods for the production of vaccines, bacteriophage and antibiotics.

Additional information on activities within BON have been provided by an alleged eyewitness, Elizaveta Ivanovna Parshina, who, when she was a young woman, worked at the facility as a laboratory assistant. Interviewed in November 1992 by Arkadii Pasternak and Oleg Rubinkovich, investigative reporters at the Russian newspaper *Nezavisimaya gazeta*, she confirms that Faibich headed-up the facility. Parshina notes that the gates of the convent are reported to have been wrapped in thick felt, which was saturated in formalin and Lysol disinfectant. She recalls that sheep and two camels were allowed to graze in the convent's courtyard. Meanwhile, cages containing monkeys, guinea pigs and rats were maintained in the Zachat'evskaya Trapeznaya Church, a convent building dating from 1551. The main focus of BON is reported to have been on cholera (*Vibrio cholerae*), plague, malaria and tetanus (*Clostridium tetani*).[14]

Further testimony provided by contemporary eyewitnesses is cited by Fedorov who, in his history of Soviet biological weapons, refers to Ivan Ivanovich Luzhkov, who was employed at BON from 1932 where he had responsibility for BON's experimental animals and worked under Professor Sergei Ivanovich Rasputin. Luzhkov notes that local people from Suzdal were employed both in BON's vivarium and in its dining hall. He also states that Faibich was a 'good man'. Luzhkov lists the experimental animals utilised at BON as including rabbits (held within the Pokrovsky Cathedral), rats, mice, pigs and horses.[15]

Allegations of experiments on human subjects

Perhaps the most interesting part of Parshina's testimony concerns her description of experiments on human subjects in which she claims she participated. According to her account, those subject to experiments were held within the administration section of the Pokrovskaya Hotel, which was located within the convent. According to Parshina, she was highly trusted by the BON management because she was a loyal member of the All-Union Leninist Young Communist League (Komsomol), a youth organisation controlled by the Communist Party of the Soviet Union. Parshina was thus personally entrusted by Faibich with a 'special task'. She describes how she took breakfast to a prisoner and then, when his attention was diverted, surreptitiously sprinkled droplets into the air from solution in a syringe containing cholera bacteria. She was then required the following day to take the prisoner's temperature, which was normal. It was at this point that a professor with a name similar to Karpukhin or Karpunun—she could not recall his name precisely—intervened and, again with the use of a syringe, contaminated part of the prisoner's lunch. Parshina reports that she later overheard a conversation that if the 'rabbit' (prisoner) involved in the experiment had been expected to survive then he would be directed to a camp. However, since it was likely he would die, he was scheduled to be shot. After the experiment, Parshina was washed with various substances and held in quarantine.[16] One should be careful in lending too much credence to the Russian newspaper's account, as it is based on a single source. There may of course have been rogue individuals, and Parshina's account deserves additional investigation by Russian historians, but it appears to be highly unlikely that any of the imprisoned microbiologists, eminent civil scientists in their own right, would have any inclination to participate in any such practices, even if actively encouraged by the political authorities.

Researchers based in Suzdal may also have used themselves as experimental subjects. Parshina reports on another professor, living in 'proud solitude', who inoculated himself with tetanus bacteria. She relates that after his death and burial, his body was subsequently exhumed for use in additional experiments.[17] The *Nezavisimaya gazeta* reporters who published the story readily admit that Parshina's account cannot be verified by personnel who were employed in secondary roles at BON. However, other parts of her story do correspond to the known facts gleaned from other historical sources.

Additional eyewitness testimony concerning the experience of political prisoners with regard to medical procedures at Suzdal is provided by Elizabeth Lermolo, who had been sentenced to eight years in Soviet political prisons in the wake of the assassination of Kirov in 1934. In 1937, she was transferred to the Suzdal Camp of Special Purpose at St Euthymius Monastery of the Saviour. She describes the wretched conditions under which prisoners were held captive, noting that: 'There was a biting, rheumatic dampness in the place. Walks were limited to fifteen minutes, and they were held in a barricaded, roofless passage, ten yards long and two wide.'[18] In addition, Lermolo describes the following incident that took place shortly after her arrival in Suzdal:

> That same month, June 1937, I was taken to the main infirmary for a smallpox inoculation. The infirmary was located at the other end of the monastery grounds, nearly a mile's walk through the vast fruit orchard. The guard kept nagging at me to 'step livelier' but I intentionally walked slowly in order to breathe in as much of the clean, fresh air as possible.
>
> In the infirmary I was met by the corps inspector and a young, impetuous physician. The latter felt my pulse, nodded, then, after examining against the light a syringe which was filled with a green liquid, he said to me, 'I'm giving you an antityphus injection.'
>
> 'Not smallpox?'
>
> 'Oh, well … it's the same thing. Take off your robe and roll up your sleeve. Stand still,' he ordered, and plunged the needle into my arm. The needle was inordinately thick. I screamed. The corps inspector and guard took hold of me. The physician pierced the needle in deeper, then slowly pulled it out.
>
> 'That's done,' he said. 'Call in the next prisoner. And let's try to speed it up a bit. It's taking much too long.'
>
> I was led back to the isolator by a different route, presumably so as not to run into other prisoners who were coming for their shots. On the way I began to feel ill, and as soon as I crossed the threshold of my cell I started to vomit. For the rest of the day I suffered from nausea. My head ached, I felt feverish, every part of my body was in pain.
>
> By nightfall I heard groans from all the cells around me. The women wept, called for the doctor, demanded water, banged with their fists against the door. The guards ignored the clamour.
>
> In the morning, the corps inspector came into my cell and despite my protests, folded the bed against the wall and locked it.
>
> On the third day, I discovered to my horror that my hair was falling out. At first I thought it was a nightmare. But, alas, it was only too true. It was falling out by fistfuls, until soon I was quite bald. To add to my feeling of panic at this development, all around me I heard the shrieks of prisoners who were no doubt similarly affected. The women, in particular, were hysterical. But the officials of the isolator remained unmoved. One woman who had screamed and shouted incessantly was put in a strait jacket.

> In providing me with a small kerchief to cover my head, the corps inspector tried to reassure me. 'The injection', he said, 'was not harmful. It won't endanger your life or impair your health. The doctor assumes full responsibility. It was done for your own good.'
>
> 'I don't want you to do anything for my good. Let me out of jail and I'll take care of myself.'
>
> 'That's not up to me. The chiefs will decide that.'
>
> It took several weeks before some hair began to grow again on my head, and that was sparse and unusually soft. I was under constant observation by the same young physician who seemed pleased with the results of his 'mass experiment'. At his behest, my head was shaved several times and rubbed with ointment.
>
> By fall, my hair had grown about one to one and a half inches. But it continued to be very thin and weak. At each combing, much of it would fall out.[19]

By June 1937, many of the scientists at BON had been evacuated from the Convent of the Intercession, and it appears that the events Lermolo describes are not connected to the work underway at the facility. However, her account highlights the sheer brutality of the Soviet penal system and the fact that the political prisoners in Suzdal were subjected to whatever medical procedures OGPU personnel deemed necessary.

The imprisoned scientists held within Stalin's BW sharashka

A significant number of the Soviet Union's leading plague and tularaemia specialists were imprisoned by OGPU within BON. In his account of the Suzdal Bureau of Special Purpose, Mark Popovsky estimates that 'about nineteen highly qualified academics were set to work developing offensive and defensive bacteriological weapons'.[20] The scientists who have been identified as having been imprisoned in Suzdal are Boris Yakovlevich El'bert, Nikolai Akimovich Gaiskii, Sergei Mikhailovich Nikanorov and Sergei Vasil'evich Suvorov. It has been suggested that in order to address the problem of attracting too few scientists to work on his BW programme, Velikanov may himself have been the driving force behind the arrest in the early 1930s of the leading infectious disease specialists from facilities belonging to the People's Commissariat of Health.[21] There is no evidence to support this theory, but he was certainly one of the main beneficiaries following-on from the arrest of the Narkomzdrav scientists.

Parshina, an apparent surviving eyewitness at BON, states that Faibich, the first director, operated a fairly liberal regime with regard to the imprisoned scientists. While they lived in the convent cells and were not allowed to leave the territory of BON, their wives appear to have been free to come and go as they pleased.[22] Demikhovskii, who was appointed head of BON in April 1934, confirms that Nikanorov and the other imprisoned scientists were subject to a 'liberal' prison regime.

> Each worked in a separate laboratory situated in small huts in the grounds of the monastery. The monastery was surrounded by high stone walls and wooden towers. The rules of imprisonment, everyday life and conditions of the scientists were 'liberal'. Members of their family lived in the town in private flats and participated in their scientific work as laboratory assistants. The gates to the monastery were manned by guards who knew the prisoners and their family members and let both in and out of the monastery. At precise times, three times a day, all the prisoners gathered in the canteen at a big table and were served politely and ate varied and high-calorie and tasty food prepared by civilian staff.[23]

Demikhovskii in his memoirs is clearly anxious to distance himself from any ill-treatment inflicted on his fellow scientists. Nevertheless, it is probably the case that the authorities were anxious to provide decent living conditions in order to boost the scientific and military output of the biological *sharashka*.

The most prominent of the Soviet scientists imprisoned in BON was Sergei Mikhailovich Nikanorov, who was a pivotal figure in the management of early Soviet programmes focused on the control of plague. He was born in 1885 in Kursk oblast', Russia. His father was an Orthodox priest. The young Nikanorov graduated with distinction from the theological college in Kursk. He then enrolled in the St Petersburg Theological Academy. However, soon after he was to transfer to the Medical Faculty at Warsaw University. During the vacations, he assisted with local programmes aimed at fighting cholera in the Kursk region. He graduated from Warsaw University in 1912 and at the suggestion of Daniil Kirillovich Zabolotny, a leading microbiologist, Nikanorov took up a position as the head of an anti-plague laboratory. In 1913, also at the suggestion of Zabolotny, he enrolled in a special training course on plague at the special laboratory of the Institute of Experimental Medicine, which was located on the Fort Aleksandr I (Kronstadt, near

St Petersburg). Nikanorov's laboratory rapidly became one of the leading centres in the Astrakhan and Ural'sk oblasts for the study and combating of plague.

Nikanorov's success in the regional anti-plague stations came to the notice of the Soviet authorities, and in July 1921 he was appointed director of the Mikrob (Microbe) State Regional Institute of Microbiology and Epidemiology in Saratov, Russian Federation. This institute was considered the leading Soviet facility for the control and study of plague, and under Nikanorov's management it rapidly consolidated this position. In 1922, in accordance with a resolution issued by the second Regional Anti-Plague Conference, five anti-plague laboratories functioning at this time in the south-east of Russia were transferred to the subordination of Nikanorov's facility. This allowed the creation and operation of a single anti-plague network, headed by Nikanorov, in the south-east of the Soviet Union. In 1923, the RSFSR People's Commissariat of Health approved the resolution of the third Regional Anti-Plague Conference (Saratov) concerning the creation of a Regional Anti-Plague Centre. The new centre was based at the Mikrob Institute and headed by Nikanorov. It played a key role in combating outbreaks of plague in the south-east of Russia. Nikanorov personally participated in the work to control epidemics of plague in the 1920s.

Nikanorov undertook a number of actions aimed at strengthening the scientific base at the Mikrob Institute. In 1922, he initiated the publication, and became the first editor of, the *Bulletin of Microbiology and Epidemiology*. In March 1924, a unique anti-plague museum was opened at the facility. At the end of the same year, on the orders of the People's Commissariat of Health of the RSFSR, he organised a three-month course at the institute for training doctors in bacteriology, epidemiology, plague and methods of combating it. He also created a scientific library within the Mikrob Institute, which, by 1925, had already amassed a collection of 1,500 volumes. On 31 January 1936, in recognition of his outstanding success, Nikanorov was awarded the Order of the Red Banner of Labour.

Nikanorov's position as the Soviet Union's lead plague expert was strengthened when he organised the second, third, fourth and fifth Regional Anti-Plague Conferences at his institute. In 1927, the first All-Union Anti-Plague Conference was held in Saratov. During this event, Nikanorov invited the leading microbiologist Semen Ivanovich

Zlatogorov and several other leading scientists to dinner. Subsequently, the two men exchanged samples of pathogens, with Nikanorov later sending to Kharkov samples of plague vaccines and strains of tuberculosis and tularaemia. Nikanorov also succeeded in winning the praise of his international colleagues. In the autumn of 1929, the German scientist V. Noller visited the Mikrob Institute. He reported to the Berlin Microbiological Society that 'Professor Nikanorov has created an organisation for south-east Russia which is engaged in first-class work.'[24]

Nikanorov is reported to have been arrested in 1930 and subsequently transferred, together with his family, to the Suzdal *sharashka*. Popovsky states that Nikanorov was shot in 1932 or 1933 because he failed to produce the desired results. Meanwhile, Fedorov claims that he was shot in Suzdal 'for making some unflattering comments about the projects conducted behind the bars'.[25] However, the Memorial Society reports that he was in fact convicted on 4 October 1937 and then executed by shooting. He was subsequently rehabilitated on 31 October 1956.

Another highly important scientist imprisoned within BON was Boris Yakovlevich El'bert. Together with Nikolai Akimovich Gaiskii, another scientist imprisoned at Suzdal, he succeeded in developing a live attenuated tularaemia vaccine. This was one of the major achievements of Stalin's nascent biological warfare programme. The collaboration between the two scientists on the development of the vaccine and their eventual falling-out is described below.

El'bert was born on 12 (25) December 1890 in Dubno, Ukraine. He had attended high school in Kel'tsy, Odessa and then graduated from the 2nd Warsaw High School in 1909. He studied at the Medical Faculty of Lemburg University (in present-day Lviv), which at this time was locatred within the Austro-Hungarian Empire. He returned to Russia in the summer of 1914, a month before the start of the First World War. From 1914 to 1915, he worked for a year in hospitals in Dubno and Berestechko, Volynsk zemstvo, Ukraine. From 1915 to 1918, he worked as a doctor and bacteriologist for the Russian Society of the Red Cross on the south-western and southern fronts, while simultaneously studying at Kiev University. He received the title of physician on 30 March 1918.

From 1918 to 1923, El'bert served as the head of the Sanitary-Bacteriological Laboratory of the Kiev Military District. Later, in 1923, in a major promotion, he was appointed as the first director of the Belarusian SSR People's Commissariat of Health's Belarusian

State Sanitary-Bacteriological Institute (Minsk). This institute was the forerunner of the current Belarus Ministry of Health's Scientific-Research Institute of Epidemiology and Microbiology (Minsk). El'bert's facility manufactured smallpox vaccines and developed methods for the control of this disease. Under his leadership, researchers also studied the features, safety and immunogenicity of a live tuberculosis vaccine. In 1925, he initiated production of vaccine-sera preparations. El'bert served concomitantly as head of the Department of Microbiology at the Belarusian State University's Faculty of Medicine.[26]

In 1924, 1925, 1927 and 1928, El'bert undertook scientific visits to Vienna, Bremen, Paris and Copenhagen and participated in the work of international congresses on scarlet fever and scleroma. These overseas visits may have made him a subsequent target for the Soviet security services. In 1931, El'bert was arrested and sentenced to three years' imprisonment. In 1932, he and his family were transferred to the secret BW facility in Suzdal.

El'bert's research in Suzdal on tularaemia appears to have met with success, and in 1937 he was released from the Red Army and sent to Frunze (present-day Bishkek) to be director at the newly opened Kyrgyz Microbiological Institute. In 1939, El'bert headed work on the organisation of the Kyrgyz Medical Institute and was its first director until 1940. From 1940 to 1944, he was the head of the Department of Microbiology at this institute. El'bert's research at this time was focused on epidemic diseases prevalent in Kyrgyzstan and on assistance to 'battlefront' medicine. In 1939, he was awarded his doctor of medical sciences degree. At the beginning of 1945, El'bert was appointed deputy director of the Rostov-on-Don Institute of Epidemiology and Microbiology, a scientific consultant of the Rostov-on-Don Anti-Plague Institute and head of the Department of Microbiology at the local medical institute. One of the reasons for his transfer to Rostov-on-Don were the outbreaks of tularaemia at this time in the Rostov-on-Don and Saratov oblasts and in Stavropol' krai.

In 1948, El'bert returned to Minsk where he concomitantly headed the Department of Microbiology of the Medical Institute until 1962, worked as the supervisor of studies at the Belarusian Institute of Epidemiology and Microbiology (1948 to 1949), headed the Laboratory of Microbiology of the Belarusian Academy of Sciences' Institute of Theoretical Medicine (1948 to 1952), and headed the Department of Microbiology at the Belarusian University (1960 to 1963). He was again awarded the title of professor in 1950. During the period 1948 to 1955 El'bert led the work of scientists in Belarus, Rostov-on-Don, Moscow, Voronezh and Smolensk on the improvement of the Soviet tularaemia vaccine. Elbert fell ill with cancer in 1962 and died in Minsk the following year.

El'bert's co-developer of the live attenuated tularaemia vaccine was Nikolai Akimovich Gaiskii. The latter, a specialist in tularaemia, was born in 1884 in the Samara gubernia. In 1912, he graduated from the Medical Faculty of the Imperial Novorossiysk University in Odessa. Gaiskii then found employment in a diagnostic laboratory in the Samara zemstvo.[27] During the period 1918–21, he served in the army. After demobilisation, Gaiskii was appointed as head of a bacteriological laboratory in Krasnyi Kut (Saratov oblast'), which formed part of the network belonging to the Mikrob Institute in Saratov.[28] In 1930, he was charged with crimes under Article 58-11 of the Criminal Code of the RSFSR and sentenced to five years' imprisonment.[29] At some point in 1932, Gaiskii was transferred as a prisoner to the BW *sharashka* in Suzdal. In 1937, he was appointed head of the Ashkhabad Anti-Plague Station. From 1939 until 1947, Gaiskii served as deputy director of the Irkutsk Anti-Plague Institute of Siberia and the Far East, where he is reported to have completed his experiments on the development of a live vaccine against tularaemia. Gaiskii died in 1947.

Another of the high-ranking scientists imprisoned within BON was Sergei Vasil'evich Suvorov. He was one of the very first Russian epidemiologists. He was born on 13 (25) September 1884 in Pskov province, the son of an Orthodox priest. In 1906, Suvorov enrolled as a student in the Faculty of Medicine at the Imperial Tomsk University. In 1910, as a fourth-year student in the medical faculty of the Imperial Tomsk University, he voluntarily joined a detachment sent to combat the October 1910 to February 1911 outbreak of pneumonic plague in Manchuria. This was the worst recorded pneumonic plague outbreak in history. Suvorov's participation in this episode is of particular interest since it places him in Manchuria at the same time as Zlatogorov, who later appears to have led an offensive BW programme in Leningrad. Suvorov's bravery was awarded with a golden medal 'For Diligence', with the Anninskii ribbon.[30]

On the recommendation of the renowned bacteriologist and epidemiologist Daniil Kirillovich Zabolotny, Suvorov undertook a training course on plague and cholera at the Institute of Experimental Medicine's Special Laboratory based at Fort Aleksandr I in Kronstadt. This latter facility is also linked to the Leningrad offensive BW programme. In February 1913, Suvorov was appointed a member of the Commission for the Study of Plague at the Institute of Experimental Medicine. On 26 February 1914, he was mobilised and found himself under the command of the main representative of the Red Cross on the South Western front. On 6 June 1918, Suvorov was posted to Tsaritsyn (present-day Volgograd) as the chief doctor of the Epidemic Hospital of the Red Cross.[31]

On 19 April 1922, Suvorov was appointed assistant head of the Astrakhan Anti-Plague Laboratory. From 1922 to 1929, he also headed the Department of Experimental Hygiene at the Astrakhan Medical Institute. It was while he was based in Astrakhan that Suvorov studied outbreaks of cholera and plague. In 1926, along with his co-workers at the Anti-Plague Laboratory, Alevtina Aleksandrovna Vol'ferts and Maria Mikhailovna Voronkova, he is reported to have been a member of the first Soviet group of scientists to have isolated the tularaemia bacterium.[32]

In 1930, Suvorov was relieved from his position as head of the Astrakhan Anti-Plague Laboratory. On 30 April 1931, a decree was issued by the Nizhne-Volzhskii krai OGPU that sentenced Suvorov under article 58-10-4 of the RSFSR criminal code for counter-revolutionary activities. He was later transferred as a prisoner to BON in Suzdal. By 1935, Suvorov had been integrated within the Red Army and was appointed as a senior scientific worker in the Biotechnical Institute on the island of Gorodomyla. He produced twenty scientific papers for the institute where he was employed until 1941.[33]

From 1941 to 1945, Suvorov was employed as a doctor in the Sanitary-Bacteriological Laboratory in Saratov and Engels. In December 1945, he was appointed deputy head, and later as a doctor-epidemiologist, at the Gur'evsk Anti-Plague Station. On 24 October 1951, Suvorov was recognised as an 'Exemplary Public Health Worker' by the Astrakhan Anti-Plague Station. He died in April 1955. Suvorov was rehabilitated posthumously by the Soviet state on 23 May 1960. He was married to a fellow plague and tularaemia specialist, Maria Mikhailovna Voronkova. The Astrakhan oblast' State Archive is now the official repository of documents relating to the career of Suvorov. The collection of documents was donated to the archive by his relative N. Bendt. A large proportion of the collection consists of scientific articles written by Suvorov, including 'Two Plague Outbreaks in the Volga Delta', and 'Experiments in the Use of Chlorine and Carbon Bisulphide for the Disinfestation and Disinfection of Living Accommodation in the Time of Plague'. Other items held in the collection include biographical documents, bulletins from the Astrakhan zemstvo department of health services on the progression of plague and possible plague illnesses in Astrakhan province in 1914, photographs and so on.[34]

3

FROM DEFENCE TO OFFENCE

THE DEVELOPMENT OF THE RED ARMY'S BIOLOGICAL WARFARE FACILITIES AT VLASIKHA

The closure of Department Nine

In a rather bizarre turn of events, the direction of the Soviet Union's biological warfare programme was to be dramatically altered by a chance meeting between Velikanov and Demikhovskii in a Moscow street. Demikhovskii reports that, during the encounter, relations between the two key individuals deteriorated when Velikanov suggested that the work within the Ninth Department should be run down and that Demikhovskii should facilitate the closure of the facility. Velikanov suggested that he would then arrange for Demikhovskii to be transferred to his own Red Army institute in Vlasikha. Demikhovskii was firmly convinced that 'this offer could be made only by an enemy—of me personally, and of the country as a whole', and he broke off all relations with Velikanov.[1] It was following this encounter that Demikhovskii was summoned to a meeting with Fishman, head of VOIKhIMU, in the NIKhI RKKA director's office. Fishman informed Demikhovskii that the Ninth Department was to be closed and that all the staff would have to find alternative employment.

The 1934 secret memorandum to Stalin on the use of bacteria in future warfare

On 27 March 1934, Voroshilov delivered a top secret memorandum for Stalin on the use of bacteria in future warfare. It had been prepared by Nikolai Nikolaevich Ginsburg and Abram Moiseevich Yurkovskii, both heads of BW groups working under Demikhovskii in Department Nine at the Institute of Chemical Warfare Defence. In their preamble, Ginsburg and Yurkovskii noted that:

> The question of using bacteria in future warfare has received considerable attention among imperialist countries over the years … The information that finds its way into the press … demonstrate [sic] beyond a doubt that this issue has long since passed from the discussion stage as a hypothetical matter and is now at a stage where the technical means and tactical conditions for its application are being developed.[2]

The Soviet scientists go on to note that, during the period 1926 to 1928, Fishman had created a special laboratory for this purpose and that 'the first satisfactory results were achieved, making it possible to continue research on special offensive and defensive topics'.[3]

Ginsburg and Yurkovskii levelled serious criticism against the senior management of the Soviet BW programme. They charged that Comrade Velikanov was 'a man who underestimated the possibility of simultaneous and balanced research on both defensive and offensive topics' and that until mid-1930 his laboratory almost completely switched over to research on bacteriological defence. This development allegedly 'caused substantive disagreements and conflict between Comrade Velikanov and some of his colleagues in the Military Medical Directorate of the Workers' and Peasants' Red Army'.[4] They noted that it was only after mid-1930 that Velikanov's facility switched over to research on offence and:

> In three years of work it has achieved concrete results that make it possible at this time to state with confidence that not only has a fundamental resolution of the feasibility of bacteriological warfare been accomplished in principle, but also a concrete prototype of a bacteriological weapon has been developed.[5]

The scientists pointed to work conducted on anthrax and tularaemia as demonstrating that they had weapons applications.

Ginsburg and Yurkovskii saved most of their invective for Demikhovskii's leadership within Department Nine, referring to:

> the complete lack of initiative and character of the former director of Section 9 Comrade Demikhovskii, his inability to supervise, his lack of authority within the section, and his inability to demonstrate to the command the necessity and importance of large-scale development of the project entrusted to him led to the mothballing of the department as a result of recent events, and all of its staff have been released.

The scientists claimed that:

> Constant uncertainty regarding the prospects of developing [cropped term in original document], constantly changing research directions and paces, the failure of plans, and many other similar phenomena were common occurrences in the life of Department Nine. As an illustration we might point out just two canceled expeditions (1931, 1933) to a remote location for practical field testing of the section's laboratory innovations in preparation for the expeditions much energy and effort were expended, a waste that painfully affected the section staff members.[6]

Ginsburg and Yurkovskii also pointed to failings in the observance of critical safety requirements, which resulted in infections of personnel with anthrax, tularaemia and brucellosis.

Ginsburg and Yurkovskii then issued the following appeal to the Soviet leadership:

> Working in this area from the very beginning of its research in the USSR, and understanding the extraordinary importance and the urgency of this problem for our defense, we consider it our civic duty to protest most categorically the lack of appreciation we in the USSR have had with regard to this topic. The suspension of this effort at a time when it is being actively researched abroad is simply intolerable. In bringing all the above to your attention, we ask you to get this effort back on track immediately and resolutely and assign it the priority and resources that it deserves … We believe that it is necessary to: 1) Reactivate this project as quickly as possible. 2) Give it the fullest opportunity to grow and develop normally within the Chemical Warfare Directorate system, having made the appropriate decisions on personnel, resources, facilities, etc. 3) Replace the front-line management of the section, i.e.,

> Demikhovskii, who could not cope with his assigned task, who was not able to provide authoritative leadership for the project, who discredited himself and led the project to its suspension. We are certain that your personal involvement will inspire the staff of former Section 9, which always approached its work with exceptional love, enthusiasm, and selflessness in completing the most weighty mission entrusted to it by the Party and the Government—to give our Red Army prototypes of a new state-of-the-art weapon.[7]

Stalin's first intervention and the formation of a 'single powerful BW institute'

Demikhovskii was clearly unaware of the attack on his management abilities by his subordinate scientists and continued to believe that the decision to close Department Nine had been provoked by Velikanov. In an effort to save his department, he sent his own report to Voroshilov. The various memorandums appear to have come as a surprise to Stalin, who up until now had only been aware of the biological weapons research being pursued at Vlasikha and at Suzdal' by scientists imprisoned by the security services. Stalin made a decision to call a meeting of the Politburo to hear reports relating to Soviet biological weapons programmes.

The Politburo meeting took place at 16.00 on 15 April 1934. Besides Stalin himself, among the political leaders attending the meeting were: Vyacheslav Mikhailovich Molotov (the chairman of the Council of People's Commissars); Mikhail Ivanovich Kalinin; Lazar Moiseevich Kaganovich; Valerian Vladimirovich Kuibyshev (director of Gosplan); Kliment Efremovich Voroshilov (people's commissar for military and navy affairs); Grigol Ordzhonikidze (people's commissar of Soviet heavy industry); Andrei Andreevich Andreev; Genrikh Grigor'evich Yagoda (at this time, deputy head of OGPU); and Anastas Ivanovich Mikoyan (people's commissar for external and internal trade). As well as Demikhovskii, the scientists attending the meeting included Fishman (head of VOIKhIMU), Yanel' (head of NIKhI RKKA) and Velikanov. The latter is reported to have given a fifteen-minute presentation on the work of his facility in Vlasikha regarding the immunisation of horses with botulinum anatoxins. He related that sera were then produced, which were found to be highly effective in the treatment of individuals in the early stages of poisoning. Velikanov's report was apparently not well received by the Politburo.

Demikhovskii then presented a detailed account, which overran the time allotted to him, to the Politburo of the research undertaken by his Ninth Department. Stalin is reported to have displayed intense interest in Demikhovskii's account, walking over and placing his foot on the chair next to Demikhovskii and putting forward a barrage of questions. The Politburo members also participated in the discussions. Demikhovskii states that it became clear that Fishman had not informed the Politburo of the work of his secret Ninth Department. Stalin concluded the meeting at 22.00 hours with the statement that 'It is clear that all institutes working on the problems of bacteriological war must be combined into a single powerful institute. We can appoint Velikanov as its head, and Demikhovskii as his first deputy.'[8]

Stalin's subordinates acted very rapidly upon the instructions of their leader, with all the country's BW facilities being brought under the control of the Red Army's VOKhIMU. The very next day, on 16 April 1934, Demikhovskii was appointed as Velikanov's first deputy. In his new role, he had to leave immediately with his family for Suzdal' (Vladimir oblast') where he took up his new position as head of BON. In addition, Demikhovskii's Department N at NIKhI RKKA (Moscow), comprising sixty-five personnel, also joined Demikhovskii at the Pokrovsky Convent. Both BON, subject to Red Army control, and Department N, also based in Suzdal, now formed part of Velikanov's facility, the single powerful institute that Stalin had demanded should be created.

In his new position as first deputy director, Demikhovskii was apparently excluded by Fishman and Velikanov from planning the research programme of the new combined institute. According to him, 'My suggestion of provisionally discussing the general plan of work was categorically refused.' Not deterred, Demikhovskii continued to drip poison in Stalin's ear with regard to Velikanov, and wrote a letter to him several pages long, outlining his views on the priorities for research on biological weapons. Although he received no formal response to his letter, Demikhovskii was now looked upon with favour by the central authorities. As a result, he was appointed as a member of the People's Commissariat of Health's Commission on Highly Dangerous Infections. On two occasions, he was also invited to important public funeral ceremonies attended by Stalin.

Demikhovskii's relations with Velikanov further deteriorated after Velikanov ordered Demikhovskii in 1934 to lead an expedition to

Murmansk for five months in order to 'Study reserves of protein from products of the northern seas that could be used to produce media.' Velikanov was presumably anxious to be rid of his hostile colleague, for a few months at least. Demikhovskii subsequently faced charges connected with allowing a scientist repressed by the authorities access to a loaded revolver, which culminated in his dismissal from the Communist Party. However, he was later reinstated by Matvei Fedorovich Shkiriatov, the chairman of the Communist Party's Central Control Commission, and Velikanov and members of the Party Office were 'reprimanded for their non-objective attitude to the principled Communist, Demikhovskii'.[9]

In August 1934, a large part of Demikhovskii's department, together with the bulk of the imprisoned microbiologists, was transferred by a special train from Suzdal to the Red Army's institute at Vlasikha. Demikhovskii was ordered to hand over the command of BON and its remaining scientists to Colonel Mikhail Mikhailovich Faibich. The Suzdal facility was henceforth known formally as the Fifth Department of the Biochemical Institute. Subsequently, it was renamed as the Third Experimental Laboratory of the People's Commissariat of Defence. According to Fedorov, two groups of specialists remained in Suzdal. One focused on veterinary diseases and the use of biological weapons against animals and included the scientist S.V. Rasputin. The other group comprised leading experts on plague and tularaemia, including Sergei Mikhailovich Nikanorov, Suvorov, Gaiskii and El'bert. The Third Experimental Laboratory was subsequently transferred to Gorodomyla Island on Lake Seliger.

Stalin's intervention was to have further repercussions for Velikanov and his Vlasikha facility. In the late summer of 1934, Voroshilov, the people's commissar for defence, transferred the institute from the Red Army's Military Sanitary Directorate to its Military-Chemical Directorate (VOKhIMU). Fedorov argues that this was a pivotal reorganisation marking a major switch in emphasis towards offensive biological warfare.[10] German wartime intelligence certainly confirms the change in subordination of the institute and notes that a prisoner of war employed at the facility reported that in the autumn of 1934 it 'received BW assignments from the higher Soviet and party authorities'.[11] Given the major change in focus and management, VOKhIMU chose to rename the facility at this time as the Biochemical Institute of the Red Army (Military Unit No. 1094).[12] In late November 1934, presumably just after its reorganisation, Fishman called Velikanov's attention to two recent fires at the facility—no doubt the Party leadership suspected sabotage.[13] Be that as it may, Velikanov remained as head of the new facility with his wife, Zoya Ivanovna Mikhailova, initially heading-up one of the leading departments and then from 1935 to 1936 serving as a deputy director.[14] By the summer of 1935, the newly reorganised Biochemical Institute was conducting its first open-air trials at the Shikhany proving ground (see Chapter 6).

The Biochemical Institute was supplied with both Soviet and foreign equipment, and a range of laboratory animals—horses, monkeys, rabbits, guinea pigs and white mice—were purchased for use in experiments and the production of sera. Construction also began of a large school building for the children of personnel working at the site. Velikanov's presence was now required round-the-clock at the facility. In 1937, he and his family moved from their apartment on Bolshoi Gnezdnikovskii pereulok, building 10 (located just off the main Tverskaya ulitsa) in Moscow to Vlasikha. They had been living at the Moscow address since 1924.

There is at least one eye-witness testimony available with regard to activities at Vlasikha at this time. In June 1989, the Russian newspaper *Meditsinskaya gazeta* (Medical gazette) published an article by Velikanov's son, Vladimir Ivanovich Velikanov, which the latter had written to mark the ninetieth anniversary of his father's birth. In December 1989, in response to the publication, Vladimir Velikanov received a letter from Colonel (Reserves) Iosif Aleksandrovich Chalisov, who reported that he had worked in Vlasikha from 1934 to 1937 under his father and his mother, Zoya Ivanovna Mikhailova. Chalisov, who believed himself to be the sole survivor of those who had been employed at the facility at that time, provided some details about his own background, noting that he graduated in 1932 from the Medical Faculty of Rostov University. He arrived in Vlasikha in 1934 and was appointed by Velikanov as head of the Patho-Morphological Laboratory. Chalisov's wife, Klavdiya Nikolaevna Chalisova (née Shevchenko) also worked in the lab. Chalisov appears to have remained at the Red Army facility until 1954 when he was transferred to the Military Medical Academy in Leningrad.[15] Chalisov was awarded the State Prize and two Orders of Lenin and was the author of 200 scientific publications, of which ninety-two were classified. He died in St Petersburg in 1995.[16]

Chalisov reports that he witnessed the construction of a two-storey structure that became the main building of the institute. Mikhailova had her office on the second floor of this building. Velikanov and his family had their own single-storey living quarters on the Vlasikha site. Chalisov reports that Velikanov's plan of scientific work was enormous and that a group of civilian professors from Moscow and other towns were selected to work at the facility. These included: Professor Stepan Vasil'evich Korshun (director of the Institute of Microbiology, Moscow); Boris Yakovlevich El'bert; Osip Grigor'evich Birger; F.G. Berngof; A.N. Savateev; and Professor V.M. Gubin. Birger, a leading expert on cholera, anthrax and other infectious diseases, is known to have been arrested on trumped-up charges in 1929 and probably served in the Red Army facility up until 1935.[17] Among the military personnel identified by Chalisov as being heads of laboratories and departments at Vlasikha at this time were: Mikhail Mikhailovich Faibich; A.A. Dorofeev; R.V. Korneev; Belenkov; Neustroev; Bakina; Pavlov; Mrykin; and Kruyakov. Chalisov confirms that a branch of the institute was created on Gorodomyla Island.[18]

Chalisov's inclusion of Professor Stepan Vasil'evich Korshun in his list of civilian scientists working under Velikanov is interesting. Since 1923, Korshun had been the director of the Moscow I.I. Mechnikov Institute of Infectious Diseases. On 15 November 1927, no less a figure than Velikanov himself had been appointed his assistant director at the facility.[19] Korshun was arrested on 13 August 1930 by OGPU as the alleged leader of a group of forty-seven microbiologists accused of trumped-up charges of anti-Soviet activities.[20] Korshun died in captivity in 1931.[21] Although it appears unlikely, it is possible that he was employed at Vlasikha for some period of time after his arrest, but this would have been before the arrival of Chalisov at the site. The tempestuous interaction between Korshun and Velikanov is discussed below. A number of Velikanov's former colleagues from the Moscow I.I. Mechnikov Institute of Infectious Diseases were also arrested and transferred to the Vlasikha facility. In 1931, for example, Viktor Andreevich Bashenin, a leading epidemiologist, joined the Red Army's institute.[22] Another former Mechnikov scientist who was transferred to Velikanov's facility was Pavel Pavlovich Dvizhkov. During the period 1934–7, he headed up the Morbid Anatomy Department in Vlasikha.[23]

Stalin's second intervention: the fall of Efim Il'ich Demikhovskii

Demikhovskii recounts that he attended a meeting of the Central Control Commission on 15 March 1935, which Stalin had called to discuss the results of the new consolidated institute. Stalin's diary, however, records the meeting as having taken place on 8 March 1935.[24] Among those attending were members of the Politburo, including Nikolai Ivanovich Ezhov (chairman of the Central Commission for Party Control), Tukhachevsky (assistant in the People's Commissariat of Defence), Velikanov, Yaffe and Fishman. In reference to the dispute between Velikanov and Demikhovskii, Stalin stated that 'The way to seek out Trotskyists is not the way you did it Comrade Velikanov. Comrade Demikhovskii approaches the question of bacteriological war in a new way.'[25]

Before the start of the meeting, Stalin enquired what Demikhovskii's opinion was of Yaffe, and Demikhovskii responded with a positive description of him as both a Communist and a scientist.[26] Demikhovskii's defence of Yaffe at the meeting with Stalin may have been a catastrophic mistake. Yaffe had previously spent more than a decade in North America, which presumably made him an object of suspicion for the Party leadership. There is evidence that he was not trusted. Some months before, on 24 September 1934, Kaganovich had written to Stalin: 'On your instructions Comrade N. Kuibyshev reviewed the material relating to Yaffe's statement on military-bacteriological work. The situation there is very bad.'[27]

Stalin opened the meeting and unexpectedly requested that Demikhovskii, occupying a lower rank than Fishman or Velikanov, speak first and provide an account of the work undertaken by the combined institute. In his memoirs, Demikhovskii recounts that

> I began with what I considered the main task of the Institute which was the study of strategies and tactics for a possible bacteriological war, the ways in which bacteriological weapons might be used. Nonetheless, the main efforts of the institute in Vlasikha, just outside Moscow, during the whole year, had continued to be the study of methods for the diversionary use of botulinum toxin and the means of detoxifying it. This work would not contribute anything significant to the conducting of war. The responsibility invested in me as first deputy of the combined institute required, above all, my participation in the elaboration of the

> work plan. But the boss had invented various means of isolating me from this function, keeping me far away from the Moscow region where the work on botulism was being continued. When two directors of an institute follow contradictory directions in their work, the only way of ending the ineffectiveness of the institution must be their separation. I asked to be relieved of my duties.[28]

Stalin is reported to have reacted with anger to Demikhovskii's speech and stated 'Comrade Demikhovskii, of this act I do not approve. Bolsheviks fight for their views to the last drop of blood.' Demikhovskii believes, probably justifiably in the light of subsequent events, that he and Yaffe were highly fortunate to have only been dismissed on indefinite leave from the Red Army staff. Stalin's suspicions did, however, eventually catch-up with the unfortunate Yaffe, who was subsequently arrested by the security services on 29 September 1937. He was executed on 8 February in the following year on trumped-up charges of belonging to a terrorist organisation and subsequently rehabilitated on 28 September 1957.

From this point on, Demikhovskii himself was excluded from any further participation in the Soviet biological weapons programme. His survival to an old age is largely attributable to the fact that, from henceforward, he fell out of the orbit of Stalin's attention. In 1935, Demikhovskii was appointed a lecturer at the Department of Microbiology at the First Moscow Medical Institute. In 1936, he defended his dissertation here. From 1938 to 1947, Demikhovskii headed the Department of Microbiology at the Alma-Ata Medical Institute (Almaty, Kazakhstan), where he was actively engaged in the training of scientific cadres. He combined his pedagogical activities with his responsibilities as the deputy director for science at the Institute of Epidemiology and Microbiology. In 1940, Demikhovskii participated in operations to eliminate an outbreak of dysentery in Ushtobe, Kazakhstan. Demikhovskii defended his doctoral dissertation in 1942. From 1947 to 1972, he served as the head of the Department of Microbiology at Dnepropetrovsk Medical Institute.[29]

Demikhovskii went on to hold a number of important positions with regard to Soviet microbiology. From 1939 to 1956, he was a member of the board of the All-Union Society of Microbiologists, Epidemiologists and Infectionists. From 1965 to 1970, he was editor-in-chief of the interdepartmental publication *Antibiotiki* (Antibiotics). For a number of years, Demikhovskii was a member of the editorial council of the *Microbiological Journal*. He was also deputy chairman of the board of the Dnepropetrovsk oblast' Society of Microbiologists, Epidemiologists and Infectionists. Demikhovskii was the author of many scientific publications, 120 of which have appeared in the open literature. He also wrote two manuals and four textbooks on microbiology for students. He supervised the defence of three doctor of science dissertations and twenty-five candidate of science dissertations. On 15 June 1995, Demikhovskii died in Dnepropetrovsk aged ninety-five.[30]

In the late 1980s, Demikhovskii wrote his memoirs detailing the offensive biological warfare experiments in which he had participated. However, the memoirs were rejected by a number of publishers and were never released during his lifetime. In his memoirs, he was still prepared to defend the offensive biological warfare experiments in which he participated: 'with the exception of the two unfortunate cases with personnel, the experiments conducted did not break humanitarian laws; the experiments were conducted on animals and often with model pathogens that were not harmful to humans. All this appears completely harmless in comparison to the experiments being conducted in Japan.'[31]

4

THE SOVIET UNION'S SECRET OF SECRETS

THE CREATION OF BW FACILITIES ON THE ISLAND OF GORODOMYLA

By 1935, the Soviet military was becoming increasingly concerned that testing at Vlasikha involving dangerous infectious diseases could conceivably pose a threat to Moscow. It was therefore decided to create a new branch of the Red Army's Biochemical Institute based at Gorodomyla Island on Lake Seliger, close to the town of Ostashkov in Tver oblast'. Here, the military appropriated pre-existing facilities belonging to the Foot-and-Mouth Disease Institute, which had been operating under the People's Commissariat of Health since 1932.[1] It had apparently developed and field-tested a foot-and-mouth disease vaccine, and the institute's reputation was such that it organised an international conference on the disease. The island itself first appears to have been appropriated from a local monastery by the Soviet authorities at some point around 1928. Ascetic monks were ruthlessly evicted, and according to a local legend 'one of the defiant monks drowned himself in the internal lake on Gorodomlya and since then his ghost wandered around the island'.[2]

This was an ideally remote location for Velikanov's new branch, surrounded by countless swamps and evergreen taiga, and located some 316 kilometres (170 miles) from Moscow in the Upper Volga region.[3]

Even today, Ostashkov is difficult to access. It can be reached by a five-hour car drive or alternatively via a twelve-hour journey by train.

At some point around this time, Velikanov's main facility at Vlasikha was renamed as the Biotechnical Institute (Biotekhnicheskii institut). The branch on Gorodomyla Island was given the code designation V/2-1094 and was also known as the Velikanov Institute. Hirsch reports that:

> From the Autumn of 1935, all work of the nature of BW proper was carried out here. All work was strictly secret, and the premises and the scientific personnel were under rigorous surveillance … In the central office at Moscow remained only the less dangerous works, particularly the large scale preparation of the dry nutritive materials, but under strictest secrecy.[4]

At some point in 1936, the remaining scientists in Suzdal, attached to the Third Experimental Laboratory of the People's Commissariat of Defence, were loaded on to a special train and transferred to the Red Army facility on Gorodomyla Island. In the same year, in the only known reference to the programme of Gorodomyla, V/2-1094 is reported to have been engaged in studying animal infectivity, the effect of environmental factors on biological agents, rapid detection methods, and disinfection measures for buildings and terrain, using a number of human and animal diseases.[5] Some experiments were also conducted with regard to infecting fish—presumably to assess the potential for disrupting enemy food supplies. German intelligence was aware of the new BW facility on Lake Seliger and is reported to have discovered that it was in possession of 'cars fitted up with sprays for disseminating tularaemia. In addition they were said to have used over 600,000 rats as plague carriers.'[6]

Fedorov, drawing on the Soviet archives, demonstrates that security at the Gorodomyla Island site was a key issue. He notes that in order to conceal the precise location of the laboratory, it officially operated from the town of Ostashkov on the shore of Lake Seliger. Fedorov also reports that, on 23 August 1936, Marshall Voroshilov, people's commissar for defence, issued an official reprimand to Velikanov for permitting an unauthorised individual access to the island. By late 1936, the deployment in Ostashkov was being mooted of a 179-strong special battalion from the People's Commissariat for Internal Affairs. Its sole mission would be to protect secrecy at the Gorodomyla site.[7]

In his report to Voroshilov in February 1928, Fishman had indicated that it would be desirable to make use of the network of bacteriological institutes belonging to the People's Commissariat of Health for military purposes. The only evidence that this request was acted upon is provided by Valentin Bojtzov and Erhard Geissler in their study of early military biological programmes in the USSR. The two authors report that a public health institute attached to Dnepropetrovsk University was involved in both offensive and defensive BW tests on Gorodomyla Island. The institute apparently focused on experiments with plague and tularaemia, which included the dissemination of tularaemia bacilli in the form of dust clouds.[8] Fedorov identifies the facility in question as the Sanitary-Biological Institute, with the BW work being led by a Professor Barbolin.[9] No trace of the scientist or the institute can be found elsewhere in the historical record.

An escape from the lab: plague in Moscow, December 1939

In December 1939, the Soviet authorities were provided with a vivid demonstration of the potential dangers posed by research on highly dangerous pathogens when plague (*Yersinia pestis*) escaped from a research laboratory and reached the streets of the capital itself. The incident involved Abram L'vovich Berlin, a leading plague researcher and deputy director of the Mikrob Institute in Saratov. He also headed-up the institute's Anti-Plague Vaccine Laboratory. In 1939, Berlin, together with two colleagues, Evgeniya Il'inichna Korobkova and V.M. Tumanskii, bravely injected himself with a new experimental live plague vaccine based on the EV strain. For a long period of time, the authorities had not consented to the experiment, but they had at last relented. Fearing that administration of the unproved vaccine could itself potentially lead to infection with plague, the three researchers isolated themselves from the outside world. The scientists all survived, and the vaccine was then tested on additional volunteers.[10]

In December of the same year, Berlin undertook additional experiments on laboratory animals. He immunised the animals with the live EV vaccine strain and is then reported to have challenged them with virulent plague bacteria. It was during the course of this experiment that Berlin was infected with plague.[11] Berlin, unaware of his illness, then travelled to Moscow where he was scheduled to present a paper to the People's Commissariat of Health. He checked into the capital's Metropol Hotel. The very next day, Berlin collapsed and subsequently died. Within three days, a barber who had given him a shave, along with two doctors who had treated him at the Infectious Diseases Hospital on Sokol Hill, were all dead.

The Central Committee was quickly alerted to the outbreak and arranged for experts to be flown in from Rostov-on-Don to the capital. A plague hospital was rapidly established, and all persons who had come into contact with Berlin—along with anyone observed to be suffering from pneumonia—were placed in quarantine there. Both the Metropol Hotel and the Narkomzdrav offices were subjected to disinfection. In addition, autopsies were performed by coroners on the bodies of the plague victims. The authorities were desperate to prevent news of the outbreak leaking out internationally and so placed all this work—which was performed at night—under the strict control of the NKVD. The epidemic is reported to have been isolated and halted.[12]

The immediate consequence of the Moscow outbreak was that the authorities prohibited all plague research within the environs of the capital. It must also have provoked awareness in Stalin and other senior officials of the potential hazards associated with microbiological work in general and research focused on BW in particular. There was certainly no possibility, henceforward, of reactivating the Red Army's BW facilities in the environs of Moscow at Vlasikha.

The Great Terror and the decapitation of the leadership of the Red Army's BW programme

In 1936, Stalin and his security organs unleashed the mass repression dubbed the Great Terror. These centralised, thoroughly planned operations of state terror reached their culmination in the winter of 1937 through to the autumn of 1938, when it is estimated that approximately three-quarters of a million Soviet citizens were subject to summary execution and more than a million others were imprisoned within the labour camps of the Gulag.[13] The repression was to have an enormous impact on microbiology and resulted in the decapitation of the leadership of the Red Army's BW programme. On 24 July 1937, the NKVD, another forerunner of the KGB, issued a directive on a special purge of personnel based at water-supply stations, bacteriological stations and scientific institutes and laboratories concerned with microbiology. The directive further ordered that all foreigners and former foreigners who had been granted Soviet citizenship, those having connections abroad and active anti-Soviet elements based at the microbiology institutions were to be subjected to immediate arrest.[14]

The main scapegoat used by the security police as cover for their operation was none other than Professor Heinrich Zeiss. Geissler reports that, according to the NKVD, German intelligence had been funding a secret organisation of spies and terrorists, composed of microbiologists and bacteriologists. This organisation had been operating in the USSR since 1930. Zeiss was the alleged mastermind of the operation, recruiting Soviet public health personnel and bacteriologists for acts of treason and, in an echo of the earlier accusations against him, allegedly disclosing information to Germany regarding bacteria 'destined for war purposes'. In the event of war, it was further alleged that the members of the organisation would commit acts of bacteriological sabotage with the contamination of water and food supplies and the spreading of cholera and typhoid agents among the civilian population.[15]

Zeiss himself was let off lightly and expelled from the Soviet Union. However, a violent political storm of unprecedented proportions was about to affect the Soviet microbiology community with Geissler estimating that some forty-eight members of the alleged conspiracy were arrested during the Great Terror. The drip-drip-drip of arrests must have created an atmosphere of terror and panic among the small pool of microbiologists. The two most prominent victims were among the first to be arrested. Fishman was taken into custody on 5 June 1937 and Velikanov a month later, on 6 July 1937. One of the first civilian victims appears to have been Nikanorov, the former director of the Mikrob Institute in Saratov.[16] He was arrested, charged with assisting Zeiss and convicted on 4 October 1937 and then shot. He was subsequently rehabilitated on 31 October 1956.

Georgii Nadson, director of the Institute of Microbiology, was arrested on 29 October 1937. Next, on 5 March 1938, was Il'ya L'vovich Krichevskii, a professor at the same facility. Then came Vladimir Lyubarskii, a deputy director at the Moscow-based L.A. Tarasevich Institute for Experimental Therapy and Vaccine and Sera Control. He was arrested on 15 April 1938. One of the last to be taken was Vladimir Barykin, the scientific director of the Central Institute of Epidemiology and Microbiology. Along with other colleagues, these scientists were accused during the period of 1931 through to 1937 of having undertaken BW sabotage operations, which included contaminating food supplies and killing cattle.[17] On 14 April 1939, Nadson, Krichevskii, Lyubarskii and Barykin were sentenced to death by the Military Collegium as members of a counter-revolutionary organisation. They were shot the very next day and not rehabilitated until 1955. Among the others arrested for participation in Zeiss's alleged spy network during this wave of terror was O.A. Stepun, a deputy director at the Moscow Chemical-Pharmaceutical Scientific-Research Institute.[18]

The end of Fishman's management of the Soviet offensive BW programme

In the early 1930s, Fishman, head of VOKhIMU, appeared to be at the height of his powers. He had successfully reorganised the Soviet Union's offensive BW programme, focusing on the creation of a single powerful institute as demanded by Stalin. The Soviet authorities recognised his achievements in 1933 with the award of the Order of the Red Star. This was quickly followed by his promotion to corps engineer under the terms of Order No. 2396 issued by the USSR People's Commissariat of Defence on 20 November 1935. In 1936, he became a doctor of chemistry.

The first sign that something was amiss with regard to the security of Fishman's position came about when, sometime around March 1937, VOKhIMU lost control of the Biotechnical Institute. During the war, German intelligence discovered that the facility had been transferred to the direct control of Marshal Aleksandr Il'ich Egorov, deputy people's commissar for defence and chief of the General Staff of the Red Army, as well as being a candidate member of the Communist Party's Central Committee. Egorov himself was to be arrested in February 1938, so his tenure would, at any rate, not have lasted long.[19] Russian sources, meanwhile, contradict the German accounts and report that the institute was at this point transferred to the Red Army's chief of armaments, Tukhachevsky,[20] who was himself arrested on 22 May 1937. The decapitation of the Red Army's senior officers meant that the Biotechnical Institute was at this point operating in a power vacuum and worse was to follow with the arrest of its director, Velikanov.

Fishman, by this point, must have been anticipating what was to come. Within months of losing control of the Biotechnical Institute, he found himself among the first of a large number of prominent BW specialists to be arrested by the security organs during the Great Terror. On 5 June 1937, Fishman was taken into custody, with his active role in military cooperation activities with the German Reichswehr in the 1920s being cited in the charges against him. The NKVD then established a Special Commission 'to unmask the sabotage activity' of Fishman and his associates in the Military Chemical Directorate. According to Bojtzov, in May 1937 this commission quite terrifyingly recommended that, on condition that their health was not harmed, the accused should be subject to human experimentation. The commission justified this by noting that this measure would 'help to undo the "damage" inflicted on the Soviet biological warfare programme by the accused saboteurs'.[21]

Fishman was subsequently imprisoned for ten years and then released. After securing his freedom, he was placed in charge of the Department of Chemistry at the Saratov Institute of the Mechanisation of Agriculture. He was then appointed a senior lecturer at the Uman Agricultural Institute. He was again arrested in 1949 and exiled to Norilsk where he was a deputy head of a shop at a chemical factory. Fishman was finally rehabilitated in 1955 with the rank of major general (engineers) in the Red Army. He retired in the same year and eventually died in Moscow on 12 July 1961.

A continuing focus on tularaemia: the arrest of Velikanov and his replacement by Leonid Moiseevich Khatenever

In July 1937, shortly after the arrest of Fishman (head of VOKhIMU), Velikanov was arrested by the security organs. Leonid Moiseevich Khatenever was appointed acting director of the Biotechnical Institute. He is a little-known scientist but was in fact one of the Soviet Union's foremost experts on tularaemia. Khatenever's appointment presumably reflected the continuing Soviet military interest in the weaponisation of tularaemia. It is worth looking at the background of Velikanov's successor in a little more detail. Khatenever, a Jew, was born in Minsk, Belarus, in 1896. He attended a Jewish school in Minsk, the Belarusian capital. During the period 1918 to 1920, he served as a commissar in a Red Army battalion. Khatenever graduated from the Medical Faculty of the First Moscow State University in 1925. From 1925 to 1929, he worked in the USSR People's Commissariat of Health's Skin-Venereological Institute. In 1931, Khatenever was appointed head of the Department of Microbiology at the Belarusian Medical Institute. From 1933 to 1935, he was appointed director of the USSR People's Commissariat of Health's Scientific Control Institute of Sera and Vaccines. Khatenever was concurrently the head of the Experimental Department of the Skin-Venereological Institute. In 1935, he was awarded his doctor of medical sciences degree. In 1935, Khatenever again joined the Red Army.[22]

Khatenever's research focused on the epidemiology, diagnostics, treatment and prophylaxis of tularaemia. He became one of the Soviet Union's leading specialists on this microorganism. In 1928, he organised the Soviet Union's first laboratory for the study of tularaemia infection. Khatenever directly participated in the elimination of sources of tularaemia including at the front during the Second World War. He developed means of prophylaxis and methods of early diagnosis of tularaemia and suggested the use of the allergic reaction for this purpose. Khatenever developed a simplified method for the diagnosis of tularaemia (blood-drop agglutination on glass). He also developed methods for preparing diagnostic preparations and put forward a proposal for a therapeutic anti-tularaemia vaccine. He was the author of fifty scientific publications, including seven monographs.[23]

According to testimony provided to German intelligence by a Soviet prisoner-of-war, after Khatenever's appointment as director, a special military council was created at the Biotechnical Institute. The leading member of the council is reported to have been Brigade Commissar Saporozhets—who is reported to have later become the head of the Military Political Administration of the Red Army. He and Khatenever are reported to have led experiments on Vozrozhdenie Island in the Aral Sea in the summer of 1937.[24] At around this time, the Biotechnical Institute's former main facility in Vlasikha was relocated to join its branch on Gorodomyla Island.

Khatenever served only a year as director. His removal at the end of 1937 does not appear to be connected to Stalin's purges, and he was subsequently appointed as the head of a laboratory at the All-Union Institute of Epidemiology and Microbiology. He became a professor in 1940 and died in Moscow on 8 October 1948.[25]

Given the accusations of sabotage that were being levelled against lead military biological scientists at this time, it is not surprising to learn that the authorities sought to tighten-up control over storage and access to dangerous pathogens within the Red Army's BW facilities. On 13 October 1937, Fedor Viktorovich Rybin, head of the Red Army's Main Sanitary Administration, issued a set of guidelines for the storage and dispensing of pathogenic cultures, viruses and toxic products in military labs.[26] Clearly, the senior military personnel had at least to go through the pretence of being concerned that BW agents might fall into the hands of Red Army bacteriologists plotting against the political hierarchy—even if, in reality, they were fully aware of the fraudulent nature of the accusations.

The Sanitary-Technical Institute (STI)

By the spring of 1938, the Biotechnical Institute's personnel and equipment had been fully transferred from Vlasikha to Gorodomyla Island. On 25 April of that year, Voroshilov issued Order No. 58 decreeing that the now fully amalgamated facility was to be henceforward known as the Sanitary-Technical Institute (Sanitarno-tekhnicheskii institut or STI), also known as Military Unit No. 8,000.[27] As stated above, these organisational changes were being undertaken at the time of the Great Terror. It is therefore not surprising to learn that, against the ensuing chaos, personnel changes were frequent. After the departure of Khatenever, two additional acting directors were appointed during the period 1938–9, N.A. Spitsyn and A.A. Dorofeev. Little is known about these two individuals. Dorofeev had previously served as a head of department or laboratory at the Biochemical Institute in Vlasikha. Spitsyn was a candidate of veterinary sciences who subsequently served as full director from 1939 to 1940.[28]

By February 1939, STI is reported to have comprised seven laboratories employing twenty-eight people. The facility had at its disposal twenty aircraft, a steamer, two transport vessels, two high-speed motor-boats, three tugs and an ice-breaker, as well as ambulances and fire engines. The roster of experimental animals at the site included five monkeys, twenty horses, thirty sheep and goats, 200 cats, 200 rabbits, 2,000 guinea pigs, 2,000 white mice, 250 rats and 100 pigeons.[29]

In 1940, Major-General Nikolai Fillipovich Kopylov, a candidate of medical sciences, was appointed director of STI. He was to serve in this position right through the wartime period and led the successive evacuations of the facility, first from Gorodomyla Island to Saratov and then on to Kirov. Kopylov participated in Soviet research on the development of a live dry vaccine against plague based on the *EV* strain.

5

THE RISE AND FALL OF A WORKING-CLASS HERO

IVAN MIKHAILOVICH VELIKANOV, LEAD SCIENTIST OF THE SOVIET UNION'S OFFENSIVE BW PROGRAMME

During the period 1928–37, Ivan Mikhailovich Velikanov was the lead scientist of the Soviet Union's offensive BW programme. He was born on 7 November 1898 in the village of Yamanovo, near Kovrov in Vladimir oblast'. His father, Mikhail Ivanovich, was employed in a local weaving mill. Before the October 1917 Revolution, Ivan Velikanov was employed as a timekeeper and clerk at the local mechanical works.[1] In the aftermath of the revolution, he enrolled in the Faculty of Medicine at the First Moscow State University. He graduated from the university in 1923 and was then employed as a scientific worker and postgraduate student within its Department of Microbiology. His wife, Zoya Mikhailova, a fellow graduate from the Faculty of Medicine, also worked in the same department. The head of the Department of Microbiology was Professor Vladimir Aleksandrovich Barykin, who was also director of the Institute of Microbiology, part of the National Institute of Public Health.[2] Velikanov was engaged in research at the Institute of Microbiology. As members of the microbiology department, both he and Mikhailova were also engaged in research within the Gabricheskii Institute at the university's clinic at the former Novo-Ekaterininskaya

Hospital (Moscow).[3] During the period 1926–8, Velikanov served as an assistant lecturer and vice dean at the university.

On 15 November 1927, Velikanov was appointed assistant director at the I.I. Mechnikov Institute of Infectious Diseases in Moscow.[4] The description of this episode of his life in the work published by Aleksandr Aleksandrovich Chel'nyi allows a more nuanced and balanced view of the scientist to emerge—as opposed to the more recent hagiographies sponsored by the Russian military. At the Mechnikov Institute, Velikanov worked under Stepan Vasil'evich Korshun, with whom there were to be repeated clashes over the direction taken by the facility. Velikanov's main focus at the Mechnikov Institute was on its vaccine-sera department and its branch facility located outside the city centre. He is reported to have heaped a never-ending series of initiatives, suggestions and demands on the institute's staff, which increasingly took the form of directives and orders. However, Velikanov's intervention reportedly accelerated the work already underway on anti-tetanus and anti-gas gangrene sera, which under his direction was brought quickly to a successful conclusion.[5]

The beginning of the open conflict between Velikanov and Korshun at the Mechnikov institute appears to have begun following the appointment of Mikhail Ivanovich Baranov as head of the Red Army's Military-Sanitary Directorate. Baranov apparently began to put pressure on Velikanov, who in his turn applied the thumbscrews to Korshun. Velikanov also replaced Korshun on the Council of the All-Union Association of Microbiologists. In addition, Sergei Nikolaevich Muromtsev was transferred from the Mechnikov institute's Vaccine-Sera Department to the Institute of Chemical Defence's Ninth Department, where he headed-up a small group of bacteriologists working under Velikanov engaged in BTX research.[6]

It was in the wake of all these events that relations between Velikanov and Korshun are reported to have reached a crisis point. Korshun's patience broke, and he is reported to have issued an ultimatum to the Moscow Health Department (Moszdravotdel) that either Velikanov be dismissed or he himself would resign. In January 1929, the authorities relented, and Velikanov was recalled from the Mechnikov institute. The expulsion of Velikanov allowed the pressure that had been applied on the vaccine-sera department to be relieved. He had apparently attempted to impose unexpected and incomprehensible decisions on staff. With his departure, Velikanov appears to have appropriated the department's notebooks relating to the work on tetanus and gas gangrene. Korshun provides a penetrating pen portrait of Velikanov as 'a person giving out energy but extremely bound-up in intrigue and a careerist'.[7]

In 1927, Velikanov concomitantly enrolled within the Faculty of Philosophy at the Institute of Red Professors. This institution had been established in 1921 with the aim of recruiting and training a new socialist intelligentsia. Velikanov graduated from the institute in 1928 with the title of professor. In the same year, as has already been detailed, he was appointed head of a secret bacteriological laboratory attached to the Red Army's Institute of Chemical Warfare Defence in Moscow. Later in 1928, he was appointed as head of a new facility belonging to the Red Army, the Vaccine-Sera Laboratory, in Vlasikha. At this time, Velikanov held the rank of divisional doctor, which corresponds to the rank of major-general in the modern Russian armed forces. In a clear indication of his new status, the Soviet military authorities showered him with honours. In 1931, Velikanov was decorated under the terms of the USSR Revolutionary Military Council's Order No. 306. On 27 October 1932, he was awarded the Order of the Red Star.[8]

In September 1934, Velikanov was sent as a member of a government delegation to the 15th International Conference of the Red Cross in Tokyo.[9] This was the only time that Velikanov was allowed to travel abroad, and he was in Japan from 15 October through to 5 November. The event itself was held during the period 20–29 October 1934.[10] The Soviet delegation, which travelled initially by train to Vladivostok, was led by Christian Rakovsky, a Bulgarian socialist revolutionary and lifelong collaborator of Trotsky. He had become loyal to Stalin earlier that year and was then appointed to the Commissariat of Health. Dr Naida, a member of the Red Cross Executive Committee, also participated in the delegation.

There may possibly have been some pre-existing interaction between Soviet and Japanese BW specialists. For in April 1928, none other than Ishii Shirō, the soon to be lead figure in Japan's own notorious biological warfare programme, had departed his country for a two-year world study trip. Carrying letters of introduction from military attachés in Japanese consulates and embassies, Ishii had proceeded to visit research establishments in nearly thirty countries, including the Soviet Union.[11] It is not known which specific institutes in the USSR were visited by Ishii or whether he attempted to develop any links to Soviet military scientists. It is conceivable that he had the opportunity to meet with Velikanov, although there is absolutely no evidence of this being the case. What is known for certain is that in each country visited during his overseas expedition, Ishii 'attempted to ask probing questions of the right people—military and university scientists and some scientists in private research foundations—about their biological weapons research'. The Soviet authorities are highly likely to have viewed Ishii with great mistrust but may have attempted to use his visit to procure intelligence with regard to Japan's own military biological research. [12]

It has been speculated that during his own visit to Japan, Velikanov may have held secret talks on biological weapons, perhaps with the intention of gaining insight into Japanese programmes. Japan had not ratified the 1925 Geneva Protocol that prohibited the use in war of asphyxiating, poisonous or other gases and of bacteriological methods.[13] This may have provided the country with a greater degree of freedom with which to pursue BW research—at least overtly. Wilkinson speculates that 'because the Japanese military was working so hard to obtain an effective offensive biological weapon capability, the Soviets may have believed they could gain useful information, perhaps in exchange for vaccine or medical related information in which their research was highly advanced'.[14] It is definitely known that Velikanov did meet with two Japanese professors at this time, but the focus of their discussions is unknown.[15] It should be stressed that the existence of such interactions is not evidence of any kind of collusion, and it is highly unlikely the Soviets would share any sensitive information with a potential enemy. Velikanov's participation in the mission to Japan was eventually to cost him his life when the authorities later levelled trumped-up charges against him concerning his recruitment by the Japanese to undertake reconnaissance for terrorist activities.

Velikanov and his wife cultivated contacts with well-known English, German, Italian, French and Japanese microbiologists. Both scientists published their own articles in foreign medical journals. Mikhailova was a highly accomplished scientist in her own right. She had previously worked in 1936 both in the Pasteur Institute and at its branch in Garches, headed-up by Professor Gaston Ramon. She had also undertaken research in Italy. Mikhailova was fluent in French, German and English and maintained contact with scientists based in England, Germany, Italy, France and Japan. The couple's foreign contacts are likely to have been viewed with extreme suspicion by Stalin's henchmen during their interrogations in 1937.

Velikanov was greatly concerned with the threat posed to the Soviet Union by the deployment of biological warfare. As early as September 1931, he despatched a top-secret letter to the country's leadership, noting that 'One should make the Revolutionary Military Council aware of the reality of bacteriological warfare and of our need to undertake some practical measures to prepare for it.'[16] In 1936, Velikanov and his wife are reported to have published a book or pamphlet, *Bacteriological Warfare*. Both wrote under pseudonyms: Velikanov as 'Ivan Eifel', and Mikhailova as 'Zoya Orskaya'. The book described secret Nazi research into the spread of biological agents in the Paris metro. Igor' Valerianovich Domaradskii suggests that Velikanov's book may imply that the Soviet Union had been assisting the Germans with their BW research programmes, in much the same way that there was close cooperation in the area of chemical weapons. As Wilkinson points out, this would be a puzzling action if attempts were being made to conceal such collaboration.[17] Velikanov's book is reported to have provoked some controversy both in Europe and at home in the Soviet Union.

As well as his primary focus on offensive BW, Velikanov did make valuable contributions to the Red Army's medical programmes and defensive preparedness with regard to biological weapons. He brought into medical practice an anti-gangrene serum. This preparation was used successfully to treat tens of thousands of wounded Soviet soldiers suffering from gas gangrene in the Second World War. In collaboration with Mikhailova, he also developed and put into medical practice a serum against tetanus.[18] Velikanov's institute developed a special reconnaissance tank for the identification of biological agents dispersed by enemy troops. A universal gas mask was also developed for protection against chemical and biological warfare (CBW) agents. In addition, Velikanov's scientists are also reported to have successfully developed miniaturised laboratories for identification of bacteriological agents used in enemy attacks.[19]

In the period 1936–7, Velikanov and Mikhailova pioneered the development of new combined vaccines. Velikanov was interviewed on this work by A. Lazebnikov, a correspondent with *Komsomol'skaya pravda*, in March 1937:

> World science has tried already for a long time to replace the existing five or three injections against different infectious diseases with one equivalent one. Experiments have been done in many countries but there are no results yet. This year, in our institute, we have pulled through propitious operations of single complex vaccinations against three different infections. Lazebnikov noted that a young scholar to whom our country will be thankful for thousands of lives that were kept and will be saved during future wars, recently tested his magic serums on himself. After a car accident, Velikanov was hospitalised, in an unconscious condition and with a serious trauma. He was given a life-saving dose of his serum, which is called today 'Velikanov's serum'. I am now a living advertisement, laughs Ivan Mikhailovich.[20]

The Great Terror and the fall of Velikanov and Mikhailova

Velikanov was one of a large number of prominent BW specialists to be arrested by the security organs during the mass repression instigated within the Soviet Union by Stalin. This was part of a much wider decapitation of the Red Army that resulted in the shooting of 512 out of 767 members of the High Command with another twenty-nine perishing in jail and three committing suicide, with fifty-nine languishing in captivity. A total of 10,000 officers of the army and navy were arrested, with a further 23,000 being dismissed. Chief among the victims was Tukhachevsky. The reasons for the military purges are not fully understood, although it has been speculated that Stalin and his intelligence advisers were seduced by a Nazi campaign of disinformation. Certainly, in the case of the Soviet military biological programme, it is likely that Stalin's elimination of some of the country's principal authorities in this area of warfare meant that the USSR was much less likely to be ready to use BW when conflict broke out with Germany.

The first indications that Velikanov was under personal threat from the security apparatus came in the wake of his meetings with Stalin. These were apparently very unpleasant for Velikanov, who afterwards was invited for discussions with NKVD personnel. They believed that bacteria from his facility could potentially be used to poison the Communist Party leadership and the Soviet government. As early as the beginning of 1937, NKVD agents are reported to have begun shadowing Velikanov. They also recruited personnel from his own institute to inform on his activities. A military doctor of the second rank, Aleksandr Sigizmundovich, who was employed at the Biotechnical Institute, revealed that 'from April 1937 I was secretly involved with representatives of the NKVD and a few times I informed the NKVD about Velikanov'. In addition, Nikolai Nikolaevich Ginsburg reported to the NKVD on the harmful work of Velikanov regarding the creation of means of defence against biological weapons. Velikanov's son states that 'fear, envy and hostility drove people to report on and to slander their comrades and leaders'.[21]

Velikanov was arrested on 6 July 1937 on the territory of his own institute in Vlasikha. The arrest order No. 2709 was signed by Mikhail Petrovich Frinovskii. As first deputy chairman of the NKVD and head of the Chief Directorate of State Security, Frinovskii played a major role in drawing up the lists of those people targeted for arrest, which were submitted to Stalin for his approval. Other victims at the Biotechnical Institute included Velikanov's wife, Mikhailova (also a military doctor), his deputy director, Busanov (a chemical engineer), A.S. Kossovskii and other leading specialists.[22]

Mikhailova was in fact arrested the day after her husband had been taken into custody. Before her arrest, she demonstrated exceptional courage in the face of extreme political pressure applied by the state. On 7 July, Mikhailova attended what must have been an extraordinarily hostile meeting of the Communist Party at the Biotechnical Institute in Vlasikha. During the course of the meeting, she was expelled from the Party for not approving their decision to designate Velikanov as an enemy of the people. In her subsequent interrogation, a brutal NKVD investigator, Aleksandr Aleksandrovich Avseevich, noted in his report to Veniamin Solomonovich Agas, a Major of State Security, that Mikhailova 'behaves provocatively during interrogation and insults co-workers interrogating her'. She is reported to have insisted that Velikanov did not undertake any subversive or harmful work and stated that 'I do not approve of calling Velikanov the enemy of the people. I know him being absolutely devoted to Soviet rule and a resilient Bolshevik.' This statement was made on 5 August, some twenty-nine days after her initial arrest and interrogation. On 25 September, Mikhailova issued the following statement to Elistratov, an NKVD investigator: 'From now on I refuse to answer the proposed questions. The arrested Z. Mikhailova.'

Velikanov and his wife were held at the notorious Butyrka Prison.[23] Some idea of their treatment at the hands of the NKVD at this site can be gleaned by perusal of an account of the interrogation of the renowned botanist and geneticist Nikolai Ivanovich Vavilov, who was arrested on 6 August 1940. Over a period of eleven months, Alexander Grigor'evich Khvat, an NKVD investigator, had led the torture of Vavilov, who had been summoned to interrogations—often lasting for hours on end—some four hundred times:

> According to eye-witnesses, Vavilov could not walk unaided after these sessions; the Butyrka Prison wardens would push and prod him back to Cell No. 27 and dump him by the door; his cellmates would help him get back up on his bunk, and remove the boots from his bruised, horribly swollen feet. The professor had been subjected to the so-called stand-up, a form of torture in which a person was forced to stand for ten or more hours (sometimes this would be stretched to days, until the veins in the victim's legs would burst). After six months of such investigation, Vavilov had been turned from a strong, fit, even dandyish fifty-three-year old into a doddering old man.[24]

Velikanov and Mikhailova may have had to endure similar privations during the eight and four months respectively that they were held in captivity.

On 4 December 1937, Andrei Yanuar'evich Vyshinskii, procurator general of the USSR and the legal mastermind of Joseph Stalin's Great Purge, confirmed the final accusation against Mikhailova. Some five days later, her trial, in which she faced a capital penalty for her alleged offenses, is reported to have taken up just fifteen minutes of the court's time. As was later to be the case with Velikanov, Mikhailova refused to confess her guilt to the court. She appears to have been shot the same day that the Soviet court issued its guilty verdict.[25]

During his own interrogation, Velikanov is reported to have informed the NKVD investigator that 'I deny the accusations brought against me. I refuse to give any further testimonies.'[26] On 8 April 1938, Velikanov was accused in a closed court trial of the Military Collegium of the USSR Supreme Court of being an active participant of a military-fascist conspiracy, into which he had been tempted in 1936 by the 'national enemy', Tukhachevsky. At Tukhachevsky's command, Velikanov was alleged to have conducted sabotage in the sphere of the country's defence and prepared for the destruction of the Moscow population through food poisoning. In addition, it was alleged that during his visit to Japan in 1934, he was recruited by the Japanese to undertake reconnaissance for terrorist activities. Velikanov, who informed the court that he was falsely accused, was found guilty of these alleged crimes and condemned to death by shooting with confiscation of all his property. The Soviet authorities acted with extreme haste, and he was executed on the very same day that the court passed judgement.[27]

After his arrest and execution, Velikanov's name ceased to be referred to in the scientific literature. His books and papers were removed from libraries, and he was effectively airbrushed out of the history of Soviet microbiology. In 1933, for example, Velikanov had begun work on editing a series of volumes focused on microbiology and epidemiology. A number of outstanding Soviet microbiologists participated in this project including V.A. Ashenin, F.G. Berngof, V.A. Barykin, Osip Grigor'evich Birger, I.P. Dzhishkov, D.M. Novogrudskii, A.I. Savateev and Boris Yakovlevich El'bert. Only one volume was published before his arrest.[28] It is purely by chance that a single copy of the first in his proposed series survived until it was discovered in a technical library in the 1950s. All the other volumes that had been prepared by him with Mikhailova on gas gangrene, botulism and tetanus are reported to have disappeared without trace after his arrest.[29]

The rise of a new Russian hero: the rehabilitation of Velikanov

Velikanov and his wife were survived by two sons and a daughter, Vladimir Ivanovich, Vadim and Ninel (Lenin spelt backwards). Vladimir Velikanov eventually rose to the rank of colonel in the Soviet armed forces. He sought to rehabilitate his father at the earliest opportunity. At some point after the death of Stalin, a number of witnesses who had known Ivan Velikanov and Zoya Ivanova Mikhailova were interviewed by the KGB. These included Maria Vsevolodovna Pelevina and Natal'ya Nikolaevna Orlova from the Biotechnical Institute, and Professor Mikhail Petrovich Chumakov. Chumakov apparently appraised Velikanov highly, both as a scholar and as a person devoted to socialism and the country. He stated that 'Velikanov was an outstanding person among microbiologists … An excellent organiser, a capable scientist, always full of plans and schemes. He was able to choose a topic of the utmost importance to the country. I am convinced that he was a communist of principle and honesty.' In 1955, at the request of the KGB, a commission under the leadership of a major-general of the Medical Service, P.A. Ogurtsov, based on the instructions of the USSR Ministry of Defence's Main Military-Medical Administration, examined the archive documents relating to Vladimir Velikanov and Mikhailova. It came to the following conclusion:

> As is apparent from the official documents, I.M. Velikanov, heading the Biotechnical Institute, attempted to carry out scientific-research work in accordance with orders … From letters and reports to Comrades Stalin, Voroshilov and Molotov, and also other leading workers in the Central Committee of the VKP, People's Commissariat of Defence and the NKVD, it has been established that I.M. Velikanov generally dealt with questions in a correct manner, subject to permission, with the aim of increasing the defence capability of the country.

At Vladimir Velikanov's request, the Military Collegium of the USSR Supreme Court re-examined the files relating to the accusations against Ivan Velikanov and Mikhailova. Both scientists were rehabilitated on 13 June 1956.

In December 1993, Vladimir Ivanovich published an article on his father's career in *Voenno-meditsinskii zhurnal* (Military-medical journal).[30] The article documents the rehabilitation of Ivan Mikhailovich Velikanov and Zoya Ivanovna Mikhailova. Colonel (Reserves) Velikanov notes that the Russian Ministry of Defence granted him permission to view the interrogation files of his parents and that the article draws on information from this source. This article is highly significant since it was published by the Russian Ministry of Defence. It therefore represents an important attempt by the Russian military to create a new institutional memory of the early Soviet BW programme with Ivan Mikhailovich Velikanov, one of the outstanding microbiologists of his generation, at the very heart of the new historical account. Colonel (Reserves) Velikanov also wrote a full account of the life and work of his father in his book *Sudby lyudskie* (Human fates), which was published in Moscow in 1996.[31]

The reappraisal of Velikanov's career culminated in 2004 with this tribute made by R.N. Lukina, writing in an official volume published to mark the fiftieth anniversary of the Russian Ministry of Defence's Virology Centre:

> Ivan Mikhailovich Velikanov ranks among the outstanding microbiologists of the late 1930s–mid-1940s. Although I.M. Velikanov

does not have a direct connection to the founding of the Virology Centre, it is impossible not to give credit to this wonderful scientist, who, being one of the pioneers of military microbiology, stood at the source of the foundation of the system of anti-epidemiological defence of both troops and the population. He was the organiser and supervisor of the Red Army's Biotechnological Institute, a forerunner of the Russian Ministry of Defence's Scientific-Research Sanitary Institute.[32]

6

FROM SHIKHANY TO VOZROZHDENIE ISLAND

THE SELECTION OF OPEN-AIR PROVING GROUNDS FOR THE SOVIET OFFENSIVE BW PROGRAMME

British intelligence reports of open-air BW testing at Kolomna, September 1924

In December 1924, the British SIS reported on the testing that September of munitions charged with biological agents at Kolomna situated at the confluence of the Moskva and Oka Rivers, 114 kilometres (71 miles) south-east of Moscow. The tests were reportedly initiated by Vladimir Nikolaevich Ipatieff, who sat on the Scientific-Technical Chemical Committee (Khimkom) and was in charge of production of poison gases for the Red Army.[1] Shells containing tetanus and anthrax bacilli were reportedly fired over a short range from a trench mortar and small calibre artillery pieces. Pigs were reported to have been used as targets and 'favourable results were achieved'. Bacteriological bombs were also produced for aerial delivery. According to information obtained from a source in the office of the Chemical Section of the Main Artillery Directorate, some 122 bacteriological bombs were accumulated and held in storage at an arms dump near Moscow. The bombs had reportedly been produced within a laboratory belonging to the Moscow 'Pneumatic' Chemical Works.[2] However, the Red Army was reported to fear that, if used, the bombs might impact upon its own forces, and no further orders were given.

There is no corroborative evidence available to support the SIS report of BW open-air testing in Kolomna. Ipatieff, who fled the USSR to live and work in the United States, does not make any mention of the BW testing in his memoirs. Nor is there any trace of the Moscow chemical facility allegedly used to produce the munitions. It is interesting to note, however, that Kolomna was the site of an experimental testing ground attached to the Main Artillery Directorate, which is reported to have been operating since at least 1927.

The launch of the first expeditions to identify suitable sites for open-air BW testing, 1929–33

In Fishman's key February 1928 report to Voroshilov on the Soviet Union's preparedness for biological warfare, he had placed special emphasis on the search for a location—preferably an island—for use in field tests of bacteriological agents. In September 1929, Velikanov is reported to have led the first expedition with the aim of identifying a suitable site among the most remote islands in Lake Baikal, the Ushkan Islands. Home to the Baikal seal, these islands form an archipelago comprising one large island, Big Ushkan Island, with three smaller islets forming an arc to the east. In his 'Report on the Baikal Expedition of Section N', issued in November 1929, Velikanov notes that the island group was investigated for their possible use for 'special purposes'. However, the lead Soviet BW scientist at this time found the islands to be ill suited for open-air trials.[3]

In 1933, Karl Yulr'evich Yanel', the director of VOKhIMU's Institute of Chemical Defence (IKhO), despatched a second expedition with the aim of finding a BW testing site in Siberia. The expedition was this time led by Demikhovskii, head of IKhO's Ninth Department, which was engaged in offensive research on biological weapons. Besides Demikhovskii, the other members of the expedition were Nikolai Nikolaevich Ginsburg and A. Popov (from the Eighth Department of IKhO). In June 1933, the expedition departed by train to Krasnoyarsk. The team then sailed north along the Yenisei River through the vast expanse of central Siberia to the port of Dudinka, a distance of some 1,529 kilometres (950 miles). The Yenisei is one of the longest rivers in the world and is littered with islands. However, despite an extensive search, Demikhovskii and his colleagues failed to locate a site that would be isolated enough for use in their field experiments.[4] It is interesting to note that both Fishman, head of VOKhIMU, and Stalin had previously been subject to exile to the remote Yenisei region. Their personal knowledge of the terrain in the region with the ready availability of numerous uninhabited islands may have prompted them to initiate Demikhovskii's expedition.

Open-air BW experiments conducted at Shikhany

The secret Soviet–German Tomka project and creation of the Shikhany proving ground

In 1922, the Red Army and the German army launched a number of joint weapons R&D programmes embracing joint work on tanks, combat aircraft and chemical warfare. Under the Versailles Treaty, the Germans were forbidden to undertake tests with chemical warfare agents or to develop their associated means of delivery. Collaboration with the Soviet Union 'facilitated an evasion behind the Iron Curtain'.[5] The first manifestation of this collaboration in the CW sector was the formation of a Soviet–German company to manufacture mustard gas and phosgene at a partially built poison gas factory at Trotsk (Ivashchenko, Chapaevsk), located 40 kilometres (25 miles) from the city of Samara. Neither the tsarist nor the Soviet governments had been able to produce mustard gas in significant quantities. Dr Hugo Stolzenberg, a German engineer and entrepreneur, was placed in charge of the project, which operated under the cover of two companies. On the Soviet side, there was the Metachem Joint Stock Company for the Manufacture of Metal and Chemical Products. The Germans meanwhile operated under the Gesellschaft zur Foerderung gewerblicher Unternehmungen (GEFU; the Company for the Promotion of Industrial Enterprises). At the end of September 1923, an agreement was signed between Metachem and GEFU regarding the creation of the Bersol Joint Venture Company. Officially, the joint new facility at Trotsk was to be engaged in the manufacture of superphosphate fertilisers for agriculture. In addition, however, it was secretly to be engaged in the production of more than 1,000 tonnes of mustard gas along with a similar amount of phosgene.[6]

The Soviet side created a special technical–economic commission under the Revolutionary War Council to supervise construction.

Construction was underway by August 1924. However, by late 1925, and nearly fourteen months behind schedule, initial test runs revealed the low quality of the mustard gas that was produced. Soviet representatives are reported to have come down hard on Stolzenberg 'in frustration at the personal corruption and inefficiency which he had displayed'.[7] A Politburo Commission eventually took the decision to dissolve the Bersol joint venture, and the final meeting of stock-holders took place on 2 April 1927. The decision to discontinue cooperation with the Germans may have been influenced by the fact that the Soviet military had just successfully completed its own successful mustard gas production programme based on manufacturing technology developed by a team working under Professor Evgenii Ivanovich Shpitalskii.[8]

Joint CW experimental work may also have been conducted by Soviet and German scientists at Orenburg (then named Chkalov) located on the Ural River close to the border with Kazakhstan. In addition, in 1927, Soviet–German trials related to aircraft spray-tanks loaded with mustard gas were conducted at a proving ground located some 30 kilometres outside Moscow.[9]

Despite the setback with regard to the Bersol mustard gas plant, at the end of 1927 a secret Soviet–German agreement was reached concerning the construction of a joint chemical warfare experimental establishment at Shikhany (Saratov oblast'). The site was located 15 kilometres from the civilian city of Vol'sk, and lying at a distance of 130 kilometres down the Volga River from Saratov.[10] It had apparently been selected as early as 1924 to become a centre for Soviet chemical warfare activities. Under the terms of the agreement, the Tomka project was created with the aim of both producing chemical weapons and operating experimental establishments at the site. The main focus of the Tomka project was on the toxicology and field behaviours of mustard gas, for which the climate at Shikhany was well suited.[11] Fishman headed-up Soviet participation in the project.

According to the testimony of a former German member of Tomka, stores were transferred from Berlin to Saratov and then onwards to Shikhany. These included a Horch eight-cylinder motor car and four 10.5 centimetre field howitzers. In May 1928, the Shikhany site was subject to further expansion with the arrival of a second set of huts from Germany.[12] By the summer of 1928, CW field trials were in progress, and during the period through to 1931 around thirty German staff were based at Shikhany with some remaining until 1933 (see fig. 6). They were joined at the site by 'a rather large number of Soviet staff'. The German staff comprised a senior commanding officer, two administrators, three chemists, one toxicologist, one meteorologist, one physician, one engineer, two pyrotechnists, five laboratory technicians, three aircraft pilots, eight automobile and aircraft servicemen and one male nurse. As detailed above, they brought much of their equipment with them to the site including building materials for barracks and food supplies.

The joint experiments at Shikhany were conducted each year from May through to November, and then, at the onset of the harsh Soviet winter, the German workers returned home. A German employed on the Tomka project notes that tests were conducted with 'dispersal by artillery ... spray cans ... Aircraft bombs and tanks for spraying'.[13] German observers noted with regard to their Soviet colleagues that 'The Russians were very backward in the technique and evaluation of experiments; but they proved themselves good, teachable pupils and copied successfully a great deal from their German instructors in the course of four years.'[14] An indicator of the pivotal importance of the Tomka project is that both Tukhachevsky and Fishman were visitors to the site.[15]

From the German perspective, there is reported to have been no retention of secrets regarding the delivery of chemical weapons from their Soviet collaborators. However, there was certainly not always an atmosphere of harmonious cooperation, and there appears to have been considerable mistrust of their foreign guests on the part of the Soviet military authorities. Two Soviet scientists were assigned to each German scientist. All relations between the two parties were kept at a formal level. Political discussions were forbidden, and the Soviet workers were housed in separate barracks. Soviet scientists participated in all the trials and experiments and received copies of the reports of all German experimental results. The Soviet team was not under a similar obligation. The camp was placed under the guard of loyal Cossack troops.[16]

A description of the Tomka project has been provided by Major-General Nikolai S. Antonov, former chief of the Soviet Chemical Troops:

> The military-chemical test facility, 'Tomka', was organized in cooperation with Germany in 1926. The creation of these schools and the military-chemical testing facilities took place under conspiratorial conditions.

> The Soviet-German agreement on joint activities within the framework of 'Tomka' was signed in the name of fictitious joint stock companies ... German personnel were prohibited from making acquaintance with the local population, Soviet military personnel, or other foreign nationals. Nor were Germans allowed to leave the Shikhany region without the agreement of Soviet administrative leadership of Tomka. They were even forbidden to leave for the town of Vol'sk, located a mere 25 kilometers from their quarters in Shikhany.[17]

The cooperation at Shikhany was virtually ended in 1932 in the wake of Russian criticism of the German group for not disclosing full information on new chemical warfare agents. This came about at a time when the German researchers themselves had become increasingly uneasy about the lack of cooperation on the part of the Russians. Hirsch notes that:

> The cooperation ... was harmonious to a certain extent during the first couple of years; soon the Russians started getting quite irascible, jealous and distrustful. They made trouble, caused difficulties and sought to supervise and control the experiments to such a degree that by 1931, the dissolution of such an unnatural connection was a foregone conclusion.[18]

Despite the difficulties, joint experiments continued to be conducted at the Shikhany site until the spring of 1933. The decision to formally terminate the cooperation programme reached the German participants via their embassy in Moscow. In June 1933, Berlin assembled and despatched a dismantling squad to Shikhany, and the Germans removed their barracks from the site.[19]

Despite the attempts at strict secrecy, there is evidence that France's external military intelligence agency, the Second Bureau of the General Staff (Deuxième Bureau de l'État-major général), had been fully informed of the Soviet–German collaboration at Shikhany. In the wake of the German invasion of Paris in 1940, documents were apparently discovered at the Second Bureau, which provided full details of the Tomka project. There may therefore have been a spy operating at Shikhany during the course of the collaborative effort.[20]

The Tomka project appears to have made a valuable contribution to the Soviet offensive BW programme. In his study, Wilkinson argues that

> Russo-German cooperation was clearly significant, not only in terms of the implications it had on the Versailles Treaty, but also because

> of the research completed by German experts which would directly benefit the Soviet biological warfare programme … 'Tomka' at its height … provided vitally useful information on bomb and shell design, agent delivery, ground contamination and decontamination. This information would have allowed research on bacteria carried out at other locations within Russia to be used for offensive purposes. For example, techniques to increase the virulence and stability of anthrax could now be combined with test proven delivery methods to give an effective biological warfare capability.[21]

The Soviet military remained at Shikhany, and the proving grounds and other facilities were now officially designated as the Central Army Chemical Proving Ground (TsVKhP).[22] In the early years of its existence, the proving ground had occupied an area of 100 square kilometres. By 1938, this area had increased to 600 square kilometres, and in 1941/2 it is estimated to have occupied an area of 1,000 square kilometres. In 1940, the Shikhany site incorporated large laboratories (at least nine to ten buildings), workshops, garages, stalls for animals, barracks for experimental details, a building for the commander and his personnel, an airfield with hangers, a gas school with spacious instruction halls, a military hospital and buildings for the production of chemical warfare agents. The permanent staff at this time included: a lieutenant general (commander), a major-general (chief of staff), 100 other officers, 850 non-commissioned officers and 250 scientists and related personnel (including chemists, physicians, biologists, engineers).[23]

A Soviet prisoner of war, employed at Shikhany for four years as an assistant, informed German interrogators that trials were undertaken at the site in 1939–43 to test the dispersion of viscous chemical warfare agents in aerial bombs and aircraft sprayers. He had participated in 'some hundred such experiments, in each of which 60–80 dogs with shaven backs were used. Sometimes soldiers (volunteers) also, wearing heavy protective garments, were sprayed with viscous CW agents.'[24] Another POW described an additional experiment that was undertaken on 6–7 February 1943:

> On the experimental field, dogs were placed in a chessboard-like arrangement as experimental animals, and then gas bombs were dropped, releasing a dark brown smoke. The dogs were held there, their movement restrained. Five minutes later, bombs were dropped again,

> giving off green smoke; after a while the dogs were carried alive from the field by men wearing protective clothing ... On the following day, bombs were again dropped as described, but instead of the second bomb-dropping, the experimental field was shelled by artillery.[25]

A captured Soviet officer reported that he had been an eye-witness to these experiments, which were focused on testing 'the methods of laying non-persistent CW agents such as HCN, CNCl, mixtures of the two, Phosgene, Diphosgene, as well as their mixtures'.[26] He noted that there was a 100 per cent death rate among the exposed experimental animals—dogs and horses unfit for military service.

Shikhany's role in military-biological programmes

Shikhany's links to Russian military-biological programmes date back to 1934 when the Red Army's Military Scientific-Medical Institute (Vlasikha, Moscow oblast') is reported to have been responsible for the management of BW research at Shikhany.[27] The institute is reported to have received direct BW assignments from the higher Soviet and Party authorities and to have carried out a range of tests on BW simulants at Shikhany's Central Army Chemical Proving Ground.[28]

Fishman wanted someone on the ground whom he could trust to manage the BW tests at Shikhany and appears to have found his man in Nikolai Nikolaevich Ginsburg. On 11 April 1934, Ginsburg was first appointed as an aide to Mikhail Gendler, Head of the Red Army Military-Chemical Directorate's Biochemical Department—which was charged with the management of military-biological R&D and industrial production.[29] In August 1934, Ginsburg was then also appointed by Fishman as a member of a commission, headed by Gendler, the main responsibility of which was the organisation of biochemical field trials at Tomka, near Shikhany. This was the Soviet Union's main chemical weapons proving ground. The commission was also charged with preparing the toxicological laboratory, laboratory buildings and living quarters at Tomka for the unrolling of work during the winter period and to accommodate the specialists who were arriving.[30] Gendler and Ginsburg were presumably charged with ensuring the success of the trials of biological munitions that were undertaken by Velikanov at the Shikhany chemical weapons proving ground during this period.[31]

Gendler, a military engineer of the third rank, was a significant figure in the BW testing programme at Shikhany, and as well as heading-up the Biochemical Testing Commission and Biochemical Department, he was also head of the Scientific-Chemical Experimental Proving Ground. Unfortunately for him, he was soon to be caught-up in Stalin's Great Terror, as on 8 June 1937, just three days after the arrest of Fishman (the head of VOIKhIMU), Gendler himself was taken into custody. He was executed by shooting on 22 August 1937. His ashes are buried at the Donskoy Monastery in Moscow. Gendler was rehabilitated on 8 December 1956.

The German intelligence officer Hirsch independently confirms that BW trials were conducted at Shikhany in the summer of 1935 and that apparently these did not use dangerous pathogens. The tests are reported to have been conducted in conditions of great secrecy, and participants from Vlasikha wore the uniform of the Soviet chemical warfare personnel. This attempt at secrecy appears to have been met with a high degree of success. Hirsh reports that Soviet prisoners of war who had been employed at Shikhany were unaware of the bacteriological trials. The results of these early tests are reported to have been unsatisfactory, and they failed to develop a practical and reliable means of delivery for the military.[32]

Trials of biological agents appear to have continued at Shikhany through to at least December 1940. On that date, Major-General Kopylov, director of STI, submitted a report to Grigorii Ivanovich Kulik, first deputy people's commissar for defence and chief of the Main Artillery Directorate, requesting the use of the test-site for biological warfare tests. These were approved by Kulik and ten *ARB-K* modified aerial dispersal bombs, assembled and loaded with biological agents by STI, were despatched to Shikhany. The bombs had previously been tested many times at the site during the period 1936–7. Ginsburg was once again entrusted with the management of the tests.[33] The results were apparently unsatisfactory because 'they failed to develop a practicable and reliable method fit for military use'.[34] The risks and difficulties associated with BW tests at Shikhany, especially the proximity of the town of Vol'sk to the proving ground, eventually led to the transfer of this work to the newly established biological proving ground on the highly remote Vozrozhdenie Island in the Aral Sea.[35]

Open-air BW testing on Vozrozhdenie Island

In 1936, a 10,000-square kilometre tract of land on Vozrozhdenie Island (Ostrov Vozrozhdeniya or Island of Rebirth) in the Aral Sea was allocated to the Biotechnical Institute for its exclusive use as a new BW open-air test site. The island and the nearby city of Aral'sk (Kazakhstan) had previously been the location of a prison camp, which was composed of several settlements, where the OGPU is reported to have imprisoned so-called *kulaks*—relatively better-off peasants who were subjected to widespread persecution by Stalin's security organs. The *kulaks* were rapidly evacuated from the island before its transfer to the control of the Soviet BW facility.[36]

In a major report on the Soviet BW programme, the CIA note that Vozrozhdenie is:

> almost ideally located for BW test purposes. Second of a group of over 300 islands, it lies in semi-isolation some 300 miles from the nearest shore of the Aral Sea ... Irregularly shaped Vozrozhdenie Island measures some 17 miles long at its longest point and 10 miles wide at its widest point. Approximately 60 square miles are useable ... Vozrozhdenie's comparative isolation in the Aral Sea, the extensive expanse of water downwind from the island, and its surrounding desert regions provide considerable latitude in the type of weapons which can be studied ... The extremes encountered on Vozrozhdenie do not preclude the testing of biological materials on a year-round basis, although summer dust storms and winter blizzards may halt operations for limited periods. Thus, no natural restriction on employment of agents against man and animals is imposed; bacteria, toxins, viruses and *rickettsiae*, or their arthropod carriers can all be studied.[37]

Although written in 1961, this description of the island would have been more or less the same at the time of the launch of experiments in 1936.

Our knowledge of the initial BW testing on Vozrozhdenie Island is largely based on testimony given by a prisoner of war, captured in 1942, to German intelligence. He had been employed from the spring of 1933 through to the end of 1937 as a bacteriologist in the Red Army's BW facilities at both Vlasikha and on Gorodomyla Island. According to this source, in the summer of 1936 the first expedition to Vozrozhdenie Island was undertaken by the Biotechnical Institute. It was led by

Velikanov and his wife Mikhailova, together with a chemical engineer named Busanov. Around 100 personnel from the institute are reported to have participated in the experiments.[38]

A key prerequisite for the BW testing programme on Vozrozhdenie was the provision of suitable aircraft. Fedorov reports that, on 1 December 1936, the commander-in-chief of the Soviet Air Force, presumably Yakov Ivanovich Alksnis, issued an order creating an independent unit in the Central Asian Military District with the specific purpose of servicing the requirements of the Biotechnical Institute. The pilots were apparently informed that they were carrying munitions loaded with chemical agents.[39] By the beginning of 1937, the evaluation of the data obtained in the Vozrozhdenie experiments had been completed and planning began for the next expedition. However, in early July 1937, before their anticipated departure for Vozrozhdenie, both Velikanov and his wife were arrested.[40]

The new director of the Biotechnical Institute, Khatenever, was now charged with organising the next expedition to Vozrozhdenie Island. He was assisted in this task by Brigade Commissar Zaporozhets, a leading member of the institute's specially constituted war council. Later, in the summer of 1937, Khatenever and Zaporozhets eventually led a second expedition to the Aral Sea. Even more members of staff were to participate in the experiments than the previous year, and the institute was assigned two special ships and two aircraft for its exclusive use. On this occasion, the major focus of the testing programme was on the dissemination of tularaemia bacteria. They are reported to have been highly successful from the military point of view.[41]

Although the offensive development of tularaemia remained the major focus of the testing programme, a range of other agents were dropped from aircraft in specially constructed containers or corrugated metallic darts. Among the agents tested besides tularaemia were plague, leprosy, cholera, dysentery, typhus, paratyphus, pyaemia, tetanus and foot-and-mouth disease. There also appear to have been reports of thousands of squirrels being delivered to the island, of a variety whose fleas were capable of transmitting plague.[42] German intelligence was subsequently informed that the experiments on Vozrozhdenie Island were discontinued in the autumn of 1937 after 'the site of the Institute was allegedly discovered [and] it was transferred back to the Isle of Gorodomliya [sic] in the Lake Seliger'.[43]

It appears odd that the Soviet Union suspended its testing programme on Vozrozhdenie Island in late 1937, only a few years before the outbreak of war. It is probably the case that German intelligence was simply unaware of the continuance of such activities. Certainly, one of their key informants left the employ of the Biotechnical Institute in 1937, although he did maintain contact with former colleagues after that point. He was not, however, able to inform the Germans of the transfer of the Sanitary Technical Institute from Gorodomyla to Kirov and may have had no knowledge regarding additional testing on Vozrozhdenie Island. Ken Alibek (previously known as Kanatzhan Baizakovich Alibekov) provides some support for the theory that testing continued beyond 1937. He notes that there is a gravestone close to the army barracks on the island that belongs to a young female scientist who died as a result of infection with glanders in 1942.[44] British intelligence was able to confirm ongoing work at the site in 1949, and in 1954 it is reported that a secret base (known officially as Aral'sk -7) with a population of more than 1,000 was built on the island.

7

THE SOVIET UNION'S ENIGMA BW PROGRAMME

MILITARY-BIOLOGICAL RESEARCH IN LENINGRAD

The early Soviet BW programme originating in Moscow and its environs is now comparatively very well documented with a plethora of historical sources, both official and non-official, being made available. Meanwhile, the sources relating to an alleged programme encompassing the Red Army and the RSFSR (Russian Republic) People's Commissariat of Health facilities in Leningrad remain much more tangential and elusive. Russian official sources do not refer to this 'enigma' programme at all. The only sources currently available are a clutch of contemporary UK and German intelligence reports and the much later testimony of Kanatzhan Baizakovich Alibekov (later to take the name Ken Alibek), a former first deputy director of Biopreparat—a key organisation within the Soviet offensive BW programme of the 1980s and 1990s. The series of British SIS reports issued in the 1920s are the key source, providing an extraordinary amount of detail on the Leningrad strand of the Soviet BW programme. SIS had by this time already compiled a vast amount of information relating to the Soviet chemical weapons programme and its close linkages to German specialists in this area. The findings of the SIS reports on the Soviet chemical warfare programme accord closely to the current state of knowledge of such activities in the inter-war period. It is argued here that the SIS reports on BW activities in Leningrad, possibly drawing on the same sources as the CW reports, are also supported by the historical record and accord with all the known facts that have since emerged concerning the lives of the scientists involved.

British secret intelligence penetration of the Soviet chemical–biological network

In the period from December 1918 through to June 1923, Commander Mansfield Smith Cumming, head of the British SIS, had succeeded in establishing a number of high-level agent networks in the Soviet Union.[1] Under Cumming's successor, Rear-Admiral Hugh Sinclair, these were to produce some exceptional material. According to Michael Smith's history of SIS:

> The extent of intelligence being obtained from inside Russia was impressive, particularly on the two key military areas of interest: chemical and bacteriological weapons, and military cooperation with Germany ... The use of gas during the First World War had led to an arms race, with the British, Germans and Russians all experimenting to find the most efficient chemical and bacteriological weapons, and the most practical defences and antidotes.[2]

During the early 1920s, SIS issued a series of reports on Soviet preparations for chemical warfare, addressing both defensive and offensive aspects of the programme. Smith describes these as being 'extraordinarily detailed and well-informed reports ... based on multiple strands of reporting'. In March 1924, SIS circulated a fifteen-page summary of information procured by SIS on Soviet chemical weapons capability, a similar report having been issued the previous year. The new document, possibly drawing on information provided by a Soviet naval officer, reported that the Soviet chemical weapons programme had been reorganised under the leadership of Vladimir Nikolaevich Ipatieff. It also focused on the close cooperation between the Soviet Union and Germany in this area, including the sale of poison gases direct to Russia by at least one German company, in breach of the Versailles Treaty. The report also provided an extensive listing of Soviet laboratories and factories involved in the testing and manufacture of chemical weapons and the sites of military and air force bases where chemical munitions were stored. Details regarding the development of four new poison gases being developed by Soviet scientists were given together with an account of gas trials that had led to many casualties and had been subsequently hushed-up. The report was based on four separate sources, and it was delivered to the British chemical weapons centre at Porton Down together with an example of the main gas mask then in use in the Soviet Union. Following requests for additional information, the SIS agent was able to provide precise formulae for specific gases and more detail on the scientists involved.[3]

By October 1924, the SIS network had begun to report on Soviet work on biological warfare. A total of fourteen highly detailed reports on the Soviet BW programme were issued in the period through to 14 January 1927 and are analysed below. The intelligence sources on the bacteriological effort may have been the same as those used by SIS for generating the reports on the Soviet chemical warfare programme. One of the agents providing information for the latter was a Soviet naval chemical weapons expert, Eugen Kunitzin Neradov. Another source appears to have been Professor Nikitin, who was reported to be a poison gas expert. On 10 July 1927, the Soviet Union announced that both these individuals had been arrested by OGPU as part of an operation involving the round-up of 'more than twenty-three persons employed in the British Intelligence Service'.[4] It appears to be no coincidence that no further reports on the Soviet BW programme in Leningrad were released by SIS after mid-January 1927 (i.e. the period just before the Soviet rolling-up of the British spy network).

The role of the RSFSR People's Commissariat of Health

British secret intelligence identified the RSFSR People's Commissariat of Health (RSFSR Narkomzdrav) as being the main agency within which the enigma facilities engaged in offensive biological warfare work were concealed. RSFSR Narkomzdrav operated at the republican rather than the all-union level and therefore was at a disadvantage when seeking funding from the Council of People's Commissars.[5] Despite this relatively diminished status, significant funds for BW research were channelled from RSFSR Narkomzdrav to the Plague Fort at Kronstadt and to other laboratories in Leningrad. In 1925, for example, Narkomzdrav is reported to have directed some 290,000 roubles (around US$9 million) to its subordinate BW facilities.[6] This equates to around US$123 million at today's prices. It is interesting to note that, during the 1970s and 1980s, the Soviet Union again concealed much of its massive offensive BW programme within an ostensibly civil agency, Biopreparat, which was subordinate to the Main Administration of the Microbiological Industry under the USSR Council of Ministers (Glavmikrobioprom). The key institution operating closely alongside the Narkomzdrav facilities appears to have been the Red Army's Military-Medical Academy in Leningrad. This chapter focuses on the scientists and facilities engaged in military biological research for RSFSR Narkomzdrav and the Military-Medical Academy.

Rogue scientists or pioneering researchers? The careers of Petr Petrovich Maslakovets and Semen Ivanovich Zlatogorov

Both British and German intelligence identify two individuals, Petr Petrovich Maslakovets and Semen Ivanovich Zlatogorov, as the lead scientists in an early BW programme undertaken in Leningrad. Both men appear to have been highly capable microbiologists, although Zlatogorov was by far the more prominent of the two. He was born as Samuil Shloim Lipmanovich Goldberg in Berlin on 20 April 1873. Zlatogorov graduated from the Military Medical Academy in St Petersburg in 1897. He specialised in microbiology and worked under I.I. Mechnikov. In 1900, Zlatogorov successfully defended his Doctoral thesis ('On the Fate of Bacteria in Susceptible and Non-Susceptible Animals: An Experimental Study from the Bacteriological Laboratory of the N.Ya. Chistovich Clinic for Infectious Diseases') in St. Petersburg.[7] During the period 1905 to 1907, he served as head of the Bacteriology Laboratory at the St Petersburg Children's Hospital. He was also house surgeon in its infectious department. In 1911, Zlatogorov was appointed a professor in the Department of Bacteriology at the Psychoneurological Institute. He is reported to have given lectures at around this time on bacteriology at the Petrograd State Chemical-Pharmaceutical Institute.[8]

As an epidemiologist, Zlatogorov participated in the efforts to control outbreaks of plague and smallpox in Astrakhan province (1899), plague in China (1911), cholera in Persia (1904), exanthematous typhoid in Samara province (1915) and influenza in St Petersburg and Nyzhnyi Novgorod provinces.[9]

Zlatogorov's participation in Russian efforts to combat the October 1910 to February 1911 outbreak of pneumonic plague in Manchuria is of particular interest. This was the worst recorded pneumonic plague outbreak in history. Of the more than 43,000 recorded plague cases, only one single survivor was identified.[10] Zlatogorov participated as a member of the Russian Commission for Plague Investigation in China. In April 1911, he then participated, alongside Professor Daniil Kirillovich Zabolotny, in the International Plague Conference that was held in Shenyang (then named Mukden). Zlatogorov was elected to a three-man committee that arranged the daily work of the event.[11]

During the course of the Mukden Plague Conference, it quickly emerged that Zlatogorov was one of the scientists present with the most direct experimental knowledge of pneumonic plague. Details were provided at the conference of some of his work. He had conducted experiments to prove that the bacilli could remain alive in mucus and had mixed plague cultures with a serum of high agglutinative power and let them dry, and had found that the bacilli would remain alive for weeks. Zlatogorov also stated that he had studied forty other strains of plague bacilli from different epidemics from various countries and twenty Harbin strains. While guinea pigs experimented upon with the organisms isolated from other epidemics of plague died in seven to eight days, with the pneumonic organisms isolated in the Manchurian epidemic he found that they died more quickly, and septicaemia was mostly found. Zlatogorov also made experiments with putrefied guinea pigs and found that they contained living plague bacilli a month afterwards.[12]

What is clear from this account of Zlatogorov's participation in the Mukden conference is that he emerged at this time as one of the world's leading authorities on pneumonic plague and that he was highly active with regard to hands-on experimentation on strains isolated during the 1910–11 outbreak. It is in this context that the British SIS reports of his alleged subsequent participation in an offensive biological warfare programme make especially uncomfortable reading.

Zlatogorov was by this time one of the leading microbiologists in Petrograd, taking up a number of important civil and military posts. During the period 1918–22, he was chairman of the Petrograd Committee for the Study of Epidemic Disease and the Petrograd Microbiological Society. From 1920 to 1924, he was a professor and head of the Department of Infectious Diseases at the Military Medical

Academy and the Leningrad Gynaecological Institute. During the period 1924 to 1929, he was head of the I.I. Mechnikov First Ukrainian Sanitary-Bacteriological Institute in Kharkov.

In 1927, Zlatogorov attended the First All-Union Congress of Plague Scientists being held in Saratov. During the congress, Nikanorov, organiser of the event and head of the State Regional Institute of Microbiology and Epidemiology, Mikrob, invited Zlatogorov and several other leading scientists to dinner. Subsequently, the two scientists exchanged samples of pathogens, with Nikanorov later sending to Kharkov samples of plague vaccines and strains of tuberculosis and tularaemia.

Zlatogorov was elected to the Russian Committee of the International Microbiological Society in 1928. In 1929, he was appointed director of the Military Medical Academy's Prophylactic Institute. On 31 January 1929, he was elected as a corresponding member of the USSR Academy of Sciences' Division of Physical-Mathematical Sciences.

Zlatogorov's principal academic research was focused on the variability of microbes, which allowed him to isolate strains with the most immunogenicity for the production of vaccines. He is credited with being the first scientist to 'pose the problem of preparation of associated vaccines'. Zlatogorov is reported to have studied the aetiology and prophylaxis of measles and scarlet fever and the mechanisms of development of plague and cholera.

Drawing on original source materials from the Russian state military archives, Fedorov reports that, in 1931, Zlatogorov, by now based at the Military-Medical Academy (Leningrad), gave a presentation on biological warfare. Velikanov, an emerging lead figure in the Soviet BW programme, appears to have attended the talk, which he subsequently wrote-up as 'Concerning the Lecture by Professor S.I. Zlatogorov on Bacteriological Warfare'. Zlatogorov listed the following as agents that could be used in a biological attack: plague, tularaemia, wound infections, influenza, cholera and glanders.[13] Fedorov appears to have the incorrect date for this presentation. In December 1930, Zlatogorov was placed under arrest by the OGPU and subsequently died in hospital on 17 March 1931.[14] It is probably more likely the case that Zlatogorov gave the lecture in late 1930, shortly before his arrest, and that Velikanov wrote up his notes in 1931.

It may be significant that, in 1973, none other than Demikhovskii, formerly a lead figure in the Soviet offensive BW programme, wrote an article in the highly prestigious *Zhurnal mikrobiologii, epidemiologii i immunologii* (Journal of microbiology, epidemiology and immunology), published to coincide with the hundredth anniversary of the birth of Zlatogorov. It described Zlatogorov's contribution to the development of microbiology, epidemiology and study of infectious diseases.[15] Demikhovskii's authorship of the article could just be a coincidence, but it may reflect his recognition that Zlatogorov was a key figure in the early Soviet BW programme.

A profoundly sinister portrait is painted of Petr Petrovich Maslakovets in British intelligence documents. In August 1924, they describe him as:

> a profoundly learned man, but mentally not quite normal, being entirely absorbed in hatred of humanity as a whole … He was the first to obtain permission to experiment on live persons, this occupation of his—pure vivisection—having already given him notoriety among the prisoners, mostly political, from among whom the necessary human specimens for his research are selected.[16]

Smith, after reading the UK intelligence documents, states that Maslakovets appears to have been 'a strong candidate for the soubriquet Doctor Death'.[17]

The British description of Maslakovets is interesting, but he certainly does not appear to be the one-dimensionally sinister character painted in the reports. There are in fact strong parallels between his own formative experiences and those of Fishman, head of the Red Army's Military-Chemical Directorate. Maslakovets, like Fishman, had a quite extraordinary scientific and political career. He was born in 1871 in the village of Maslakovka, Chernigov Governorate. He studied in 1891 at Kiev University and subsequently graduated in 1897 from the Military-Medical Academy in St Petersburg. Maslakovets then served in the infirmary of the 141st Kovel Infantry Regiment. He was sentenced to three years' exile to Urzhum near Kirov (at this time known as Vyatka) because of his support for the St Petersburg League of Struggle for the Emancipation of the Working Class. During his exile in the Kirov region, Maslakovets was employed in a local hospital—quite possibly the same hospital that was later to become the location of the military BW facility in Kirov. In 1900, he took-up a senior post with the Red Cross in Pyatigorsk. In 1905, Maslakovets was arrested as a member of the Revolutionary Committee of the Pyatigorsk Republic. After being released on bail, he succeeded in fleeing abroad and then in 1906 returned to Russia. Maslakovets was then employed at the Institute of Experimental Medicine in St Petersburg. It was at this time that he was married and subsequently had a son, Yurii, and a daughter, Alla. In 1908, Maslakovets participated in efforts to counter outbreaks of cholera in Astrakhan and Samara.[18]

Upon returning to St Petersburg, Maslakovets began work in the Institute of Experimental Medicine's Department of Bacteriology, and crucially, it may be during this period, as reported by British intelligence, that he began to work in the plague laboratories at the Fort Aleksandr I (Kronstadt, near St Petersburg). In 1909, now as a doctor of medicine, he also joined the staff of the St Petersburg Medical Institute. In 1918, Maslakovets served as a doctor with the White Army during the Russian Civil War. He moved with his son to Sevastopol' in 1920 and was appointed as a deputy director of the local Bacteriological Institute. A year later, he was promoted to the position of director at this facility.[19]

In 1922, Maslakovets returned to Petrograd and joined the Medical Institute's Department of Microbiology as a senior prosector, where he was engaged in research on tuberculosis mycobacteria. His head of department at this time was Daniil Kirillovich Zabolotny who himself may have had links to the early Soviet BW programme. By 1928, Maslakovets had been promoted to head of this department. A year later, he was appointed head of the Epidemiological Department at the local Pasteur Institute. On 30 April 1931, Maslakovets was arrested by the secret police following allegations that a number of microbiologists and bacteriologists belonged to 'an organization of spies and terrorists'.[20] After receiving a five-year sentence, Maslakovets was sent to Alma-Ata in Kazakhstan. He was to die in the city from dysentery in 1933.[21]

Origins: Trotsky and the first reference to BW programmes in Leningrad

As well as pursuing their civil careers, both Zlatogorov and Maslakovets are reported by British intelligence to have also commenced, 'some years prior to 1924', military research aimed at the creation of 'bacteriological bombs'. This research was initially conducted at the bacteriological laboratory belonging to the Petrograd Medical Institute but was subsequently also pursued in a dedicated facility in Leningrad—the so-called Zlatogorov–Maslakovets Laboratory. Zlatogorov's work is initially reported to have focused on obtaining virulent bacteria and developing a means of their rapid dissemination across territory.

The first reference to BW research in Leningrad appears in a UK secret intelligence report in 1924. It notes that, on 21 July 1924, there had been a secret meeting of the Military Section of the Comintern at which the employment of biological weapons was debated. The meeting was attended by high-ranking Soviet defence officials including: Leon Trotsky (people's commissar for military and naval affairs and chairman of the Revolutionary Military Council; Revolyutsionnyi Voennyi Sovet or RVS); Mikhail Vasileevich Frunze (candidate member of the Politburo); Voroshilov (member of the Central Committee); and Lev Borisovich Kamenev (full member of the Politburo and deputy chairman of the Council of People's Commissars of the Soviet Union). In his address to the meeting, Trotsky is reported to have stated:

> I, personally, see no difference between the employment of gas or bacteriology, and, up to the present time, there has not been a single protest throughout Europe against the employment of poison gas; therefore, we, as the vanguard of the world revolution, must not only follow the methods of defence practised by our enemies, but should forestall them by the invention of new methods.

Referring directly to work underway in Leningrad, Trotsky is alleged to have stated:

> We have already commenced experimenting with the plague, cholera and typhoid bacilli. In Leningrad experiments have shown that it is possible to attack our enemy by the employment of bacteriological bombs discharged from aeroplanes. Our agents abroad and in the rear of the enemy will be provided with adequate means for spreading infection among the enemy troops and in industrial centres.[22]

If the intelligence report is to be believed, then Trotsky emerges as an important ideologue supporting the creation of the Soviet Union's chemical and biological warfare programmes in the 1920s. It is interesting in this respect that, on the evening of 19 May 1924, just a few days before the alleged meeting on biological weapons, Trotsky gave a keynote speech on chemical weapons at the Bolshoi Theatre in Moscow. Addressing an audience of more than 4,000 people, Trotsky noted in his speech that:

> We want peace ... But wars can only be avoided if we fill the hearts of the imperialists and capitalists with intense fear of our strength of arms ... For the attacks of enemy forces to be repelled, we must be armed with all the latest means of defence which modern war technique [sic] can produce. The use of poison gas in the last war requires us to keep even this means of warfare in reserve for the defence of our nation against the enemy. We arm only for defence and never for offence, for we curse war.

The meeting was attended by members of the RVS who sat at a long table on the stage, watched-over by personnel from the OGPU.[23]

The Zlatogorov–Maslakovets Laboratory and open-air experiments at Shlissel'burg

Both the British SIS and German intelligence identified a facility, operating in Leningrad under the direction of Maslakovets and Zlatogorov, which they believed formed part of the emerging Soviet BW programme. This was the so-called Zlatogorov–Maslakovets Laboratory, which operated as a department of the Leningrad Veterinary and Zoological Technical Institute (Leningradskii veterinarno-zootekhnicheskii institute).[24] The laboratory was based at Chernigovskaya ulitsa, 5. British intelligence reports on the facility first appeared in 1924. German intelligence, however, did not learn of the facility until November 1928. In that month, a report described the biological warfare activities of the laboratory, transliterated in German as the Slatogorow–Maslokowitz laboratory.[25]

British intelligence documents suggest that the original decision to create Maslakovets' laboratory was made in June 1924 by the RVS headed by Mikhail Vasil'evich Frunze. In an extract from the protocol of the session of RVS, Frunze is alleged to have stated that:

> Taking into consideration the special importance of including the new means of fighting by bacteriology into the defence of the SSSR (i.e. the USSR) to instruct the Special Technical Bureau (OTB) for Military Inventions of Special Importance to provide Professor Maslokovets with the quarters necessary to make a special laboratory ... To instruct LOVIU and the directorate of the Air Board to furnish the laboratory with all necessary testing instruments and apparatus.[26]

Maslakovets was to receive 50,000 gold roubles from RVS reserves for his experiments and to receive a training aeroplane. He was to be assisted in his work by the 'best bacteriologists desirous of assisting the State in defence'.[27]

The Maslakovets laboratory is reported to have been attached to the Special Technical Bureau for Military Inventions of Special Importance (Osoboe tekhnicheskoe byuro po voennym izobreteniyam spetsial'nogo naznacheniya or Ostekhbyuro). Ostekhbyuro itself operated under the Supreme Soviet of the National Economy (Vesenkha), which was the supreme organ of the management of the economy, mainly of industry. The Special Technical Bureau is known to have incorporated six units, including one focused on experimental research.

On 1 December 1924, a British SIS report noted that the Zlatogorov–Maslakovets Laboratory had been seeking to develop bacteriological bombs based on cultures of anthrax, tetanus, smallpox and 'epidemic encephalitis'. According to the report, most progress had been achieved with regard to anthrax, where 'not only have laboratory experiments been completed but practical experiments have been made with a small herd which was fired at from an aeroplane with specially loaded bombs. The herd proved to be sufficiently infected to assume that humans would not remain completely immune.'[28]

Maslakovets is reported to have conducted experiments with the bombs in the neighbourhood of Shlissel'burg. The latter is a town located at the head of the Neva River on Lake Ladoga, some 35 kilometres (22 miles) east of Leningrad. At 219 kilometres in length and with an average width of 83 kilometres, Lake Ladoga is the largest lake in Europe. There are around 660 islands on the lake and, conceivably, the alleged experiments conducted by Maslakovets could have been conducted on one of these. In the experiments conducted near Shlissel'burg, which were also reported by German intelligence in the 1940s, an aeroplane is reported to have dropped bombs over an area of 3.3 square kilometres on which was grazing a herd of around twenty healthy cattle.[29] The bombs each contained about 2 litres of anthrax agent. The report then proceeds to describe the results:

> The bombs which scattered the whole of the supply near the herd attracted the attention of the animals, who were at first frightened of them, but some of them came up in the course of the day to smell them. The first symptoms of the disease began to show at the end of the first week. It was

> found that the *sporae* penetrated into the lungs first, grew into the vessels, then formed vegetative forms, and only after that really brought about infection which spread to all the organs. The action was rather slow but very acute. No experiments have as yet been made with human beings.[30]

The 1924 British SIS report provides an enormous amount of detail on the alleged Soviet construction of anthrax shells enabling the optimum dispersal of bacteria. The outward form of the 65 centimetre-long shell is described as pear-shaped with a cylindrical ring at the top. It is reported to have a 2 litre capacity for loading with anthrax bacteria. The report claims that the bombs are 'prepared and stored at the laboratory of Zlatogorov–Maslokowitz at Petrograd, Tchernigowskaya Street, 5. According to the register of shell-cases delivered there, there are now in storage not less than 50 bombs of this sort, so far as is known loaded with two compositions above mentioned—anthrax and encephalitis.'

By 4 November 1924, a SIS report claimed that the Veterinary-Zoological Institute in Leningrad was being utilised by Maslakovets and Zlatogorov to undertake experiments on human subjects 'placed at the disposal of the bacteriologists by the Military Authorities (who subsidise the above-mentioned research) from the Petrograd prisons'.[31]

In January 1925, SIS reported that Zlatogorov had now separated from Maslakovets and had been transferred to Kharkov. Officially, this transfer was to take up a chair at Kharkov University, but actually Zlatogorov is alleged to have been engaged in the construction of a new laboratory and may also have been engaged in BW research at the Kharkov Zoo-Technical Institute. Maslakovets, meanwhile, continued work on the cultivation of plague at the laboratory on Chernigovskaya ulitsa. The laboratory is reported to have enjoyed exceptional privileges at this time and to be under special protection. A laboratory he operated at Oranienburg (present-day Chaplygin), near Lipetsk, is reported to have been under permanent guard.[32]

Battlefield testing of BW agents at the Kinburn testing station

Zlatogorov is reported by SIS to have been appointed chairman of a Special Test Commission that conducted major BW tests in the winter of 1925. A new facility was constructed, the Kinburn Testing Station, which was located close to the southern Ukrainian town of Ochakov, on the shores of the Black Sea. Presumably, the alleged facility was based on the Kinburn Peninsula or one its nearby islands. SIS notes that 'The more important test work, on a scale approximating real warfare conditions, was transferred to this place.'[33]

The Special Test Commission presented the results of its work to the Military Department, which was duly approved by the Revolutionary Military Council. According to the commission's report, trials of 'epidemic encephalitis' had been highly successful, and this agent was considered most suitable for application under European conditions. Trials with anthrax also showed that 'under conditions approximating to conditions of war that certain varieties of their cultures may successfully be used for infecting the ranks of the enemy'.[34]

The commission also reported excellent results with tetanus. Samples of earth were taken at a distance of 2 metres from the site of explosion of a tetanus-filled shell. When the infected samples were applied subcutaneously to mice, the animals displayed symptoms of the disease. Dissemination of the bacteria was to be achieved by shells, similar to aeroplane darts, for direct impact. Bunches of at least 200 of these darts were to be released in order to cover as wide an area as possible. The report noted that 'Use of this type of bomb is specially recommended in long-distance raids, when there is a possibility of bombing enemy cattle or reserve cavalry units.' Zlatogorov was assisted with his work on tetanus by Dr Chaimovich.[35] A British CW expert, J. Davidson Pratt, commented that some soils such as those in Flanders were already heavily infected with tetanus and that dispersing it across such territory would have very little additional impact.[36]

In September 1926, Maslakovets was reported to be operating from the Kinburn Testing Station and is reported to have been engaged in research 'on preparing bacteriological cultures of a special power of resistance for loading into artillery shells, aerial bombs and other means of distribution'. In addition to military funding, the Testing Station also received 120,000 roubles from the People's Commissariat of Health for this research programme.[37]

The focus on pneumonic plague

In November 1924, the SIS reported that Zlatogorov had initiated research on plague some years ago with the aim of 'obtaining virulent bacteria but not too epidemic in dissemination and, secondly, a method of spreading them over the territory with sufficient rapidity'. According to the report, Maslakovets, who had himself worked for a long period at the Plague Fort, was now working under the direction of Zlatogorov, and was engaged in research on the production of ampoules containing the pneumonic form of plague. These ampoules were not considered suitable for use in bombs.[38] By 1925, Maslakovets is reported to have developed a desiccated form of plague that could be held in storage for more than 100 days without any diminution in virulence.[39] This form of plague with a high degree of resistance was recognised by the Soviet authorities as being especially suitable for military purposes since it could be stored for some time before use and transported over long distances.

The British SIS report that, in 1926, Zlatogorov took direct charge of work aimed at the weaponisation of the pulmonary form of plague. This research was undertaken in the Kinburn Testing Station. There is no evidence that the Soviets at this time succeeded in developing a battlefield weapon based on pneumonic plague. As Wendy Orent notes in her monograph on plague, the process of turning the organism into a weapon involves:

> hardening off the germs until they can survive, at least for a while, in the external environment. Plague germs are not nearly as resilient as anthrax ... which forms a spore almost impervious to heat, cold, desiccation—to anything but ultraviolet light. Although plague germs can survive in the external environment for a time when cloaked in sputum, or frozen in a corpse, or buried in rodent burrows, in the atmosphere it is thought that no weaponized plague strain can last longer than about an hour or two.[40]

For this reason, rather than load the agent into artillery shells, Zlatogorov at first focused on dissemination in specially designed umbrellas, binoculars and so on.[41] Later, in September 1926, SIS reported that 'The proposed distribution of the bacilli by means of various complicated appliances has been given up and they will be spread by means of ordinary glass ampullas distributed by persons immune.'[42]

Open-air tests on Kulaly Island

An SIS report claims that BW experiments were conducted in October 1926 by the military bacteriological stations on Kulaly Island, part of the Tyuleniy Archipelago, in the north-eastern Caspian Sea. This island is the westernmost and longest in the group, stretching 25 kilometres from tip-to-tip, and is the only one currently inhabited by man. Kulaly Island was reportedly the location of a bacteriological station that had been established by the tsarist government at the beginning of the First World War in 1914 to combat malaria and other infectious diseases in the Caspian region. The tsarist authorities apparently believed that recruits from the region were spreading various diseases among frontline soldiers.[43] Bacteriological bombs, designed by an engineer called Yashin to be dropped at height from aeroplanes, were tested on the island's experimental proving ground. The bombs included quartz ampoules charged with finely cut silk or wool threads treated with bacteria. A number of experiments were conducted with bombs where the threads had merely been treated with a finely powdered fluorescent substance. Particles of this substance were found at a distance of 400 to 500 metres from the place of explosion. In addition, tests were conducted with bacterially charged bombs in order to determine their viability and infectivity.[44]

Dr Michurin, a former lecturer at Nizhnyi Novgorod University, also conducted field experiments on Kulaly Island. Michurin is reported to have belonged to an Anti-Bacteria Defence Section. He worked at this time under Professor Zlatogorov. Following theoretical work completed at the Plague Fort, Michurin commenced trials in October 1926 on Kulaly Island of a method he proposed using to counter a bacteriological attack. This involved the evacuation of all people and animals from an affected area, which could then be sterilised by the dispersal of suitable concentrations of a toxic substance. Michurin proposed the use of the most strongly toxic substances, which might in the next war be stockpiled in large quantities in the arsenals of the USSR. Among these, he included lewisite, mustard agent (yperite) and formol. In his experiments, Michurin scattered quartz ampoules containing tetanus bacteria over an area of 1 square kilometre. After three days, 500 kilogrammes of lewisite were spread over the same territory using small bombs. After another three days, samples were taken that showed that the number of viable colonies of bacteria had been greatly decreased after exposure to the lewisite. Similar experiments on plague, anthrax, encephalitis and other agents were then planned for the spring of 1927.[45] One British recipient of the SIS report of these experiments, Davidson Pratt (chief superintendent of the British Chemical Warfare Research Department), commented that 'The method of anti-bacterial defence is ingenious but the cure seems almost worse than the disease.'[46]

Interestingly, the SIS report on the experiments ends by concluding that work was progressing in the accumulation of stocks of agents for bacteriological attack, with the Revolutionary Military Council already being in possession of reserves of encephalitis and tetanus cultures.[47]

SIS consulted an entirely different source to determine the veracity of the reports concerning the use of bacteriological bombs on Kulaly Island. The new source confirmed that the tsarist government had established a bacteriological station on the island. Moreover, they were able to confirm that the Soviet government had indeed recently undertaken research at the site, which, officially at least, was aimed at developing an anti-malarial medication. The new source, while providing considerable supporting evidence that the Soviet authorities were active on the island, could not categorically confirm that bacteriological warfare experiments had indeed taken place.[48]

Secret BW research focused on Encephalitis lethargica

British secret intelligence reports suggest that Zlatogorov and Maslakovets may have been engaged in secret BW research on *Encephalitis lethargica* (EL). EL was a complex CNS disorder presenting with pharyngitis followed by sleep disorder, basal ganglia signs (particularly parkinsonism) and neuropsychiatric sequelae that appeared around the same time as the great influenza pandemic of 1918. During the period 1916–27, it is estimated that nearly five million people were affected by EL, of whom a third died in the acute stages. Since the EL epidemic took place in the same time period as the 1918 influenza pandemic, the two outbreaks have been linked in the medical literature. However, a review of the extensive literature by observers of the EL epidemic suggests that most contemporary clinicians, epidemiologists and pathologists rejected the theory that the 1918 influenza virus was directly responsible for EL.[49] More recent examination of archived EL brain material has failed to demonstrate influenza RNA, adding to the evidence that EL was not an invasive influenza encephalitis. In October 2003, UK scientists published a paper on the aetiology of EL, detailing evidence of a rare form of streptococcus bacteria in their EL patients. The findings of these researchers suggested that a massive immune reaction to these bacteria resulted in the immune system attacking the nerve cells of the brain.[50]

The first British intelligence report to identify Soviet interest in EL appeared on 4 November 1924. It noted that:

> The microbe that has been selected for producing sickness sufficient to render troops powerless, at the same time leading to fatal results in only about 25 per cent of the cases, is the one discovered only about two years ago, namely that of epidemic encephalitis, known for its pandemic property of spreading simultaneously with influenza. The microbe was discovered by Professor ZLATOGOROV after he had commenced preparations for the manufacture of biological bombs, and for this reason no reference concerning this bomb is made in any of the special literature by ZLATOGOROV. MASLOKOVETZ is only carrying out the purely technical work of directing the practical application of this microbe 'b. encephalitis epid'.[51]

The same report describes how aerial bombs had been constructed containing both influenza virus and the epidemic encephalitis microorganism—the latter held in an inner chamber containing both blood agar and brain agar. It notes that the clinical nature of the disease caused by epidemic encephalitis is unstudied. Zlatogorov and Maslakovets believed that 'All methods of combatting the disease will for a long time centre on counter-influenza measures, the encephalitis will escape notice, and its diagnosis is so difficult that it will attain a wide pandemic scale.'[52]

On 1 December 1924, a second SIS report noted that the Zlatogorov–Maslakovets Laboratory in Leningrad had been seeking to develop bacteriological bombs based on cultures of anthrax, tetanus, smallpox and 'epidemic encephalitis'. According to the report, based on the inventory of shell-cases delivered to the laboratory, some fifty anthrax and epidemic encephalitis bombs had already been prepared and were in storage at the site.[53] According to a SIS report issued on 22 January 1925, Maslakovets was at that time continuing his work on epidemic encephalitis at the Zlatogorov–Maslakovets Laboratory.[54]

Given the scale of the global EL epidemic, the British were understandably anxious to identify the causal organism of epidemic encephalitis, as is revealed by a handwritten note that appears on the next SIS report, which was issued on 11 March 1925. The report itself states that:

> The bacteria of encephalitis have been selected by ZLATOGOROV and other specialists for loading into shells for the reason that so far nothing is known concerning the data of the microbe either in specialised literature or in general way. The microbe was discovered by ZLATOGOROV in 1922, the discovery for some reason or other remaining undisclosed until MASLOKOVETS agreed to prepare it for loading into shells. ZLATOGOROV handed over all his data to MASLOKOVETS and himself continued further research along the same lines … and it was only by means of accidental treatment that the special microbe of epidemic encephalitis was discovered, named by ZLATOGOROV 'b. encephalitis epidemicis'.[55]

SIS reports that in the winter of 1925 a Special Testing Commission under the leadership of Zlatogorov undertook trials of 'epidemic encephalitis'. These were highly successful, and this agent was considered most suitable for application under European conditions. Expenditure for the production of suitable aircraft bombs was approved in the event of war mobilisation. It was concluded that 'The bacilli of epidemic encephalitis are suitable for reaction on the personnel of the enemy army and for spread in the rear in big administrative and factory centres.' It was suggested that as well as delivery via aeroplane bombs, dissemination could take place 'by agents spreading them in the enemy's rear by means of a special kind of small bombs … in outward appearance reminiscent of thick coloured pencils or some other article of general use … and the bearers will become the involuntary carriers of further infection'. The report suggests that Zlatogorov was already engaged in the production of such items.[56] In September 1926, SIS reported that epidemic encephalitis was being considered for use in peacetime to cause disruption. However, by this time, the idea concerning the dissemination of this agent by complicated devices had been given up and instead it would 'be spread by means of ordinary glass ampullas distributed by persons immune'.[57] Two months later, SIS reported that bacteriological research was being focused on epidemic encephalitis because of the ability to inoculate against the disease.[58]

From healthcare to warfare? The alleged use of the Plague Fort in the early Soviet BW programme

History of the Special Laboratory for the Production of Anti-Bubonic Plague Preparations in Fort Aleksandr I

Both the British and German intelligence services independently identified Leningrad's Plague Fort as having been an important component of the Soviet pre-war BW programme. Before examining the declassified intelligence reports, it is worth examining the history of this rather unusual structure in more detail. Fort Aleksandr I was part of the Kronstadt defence complex, situated 2 kilometres from the western tip of Kotlin Island close to St Petersburg. It was used to accommodate Russia's first specialised anti-plague facility, which was opened in August 1899.[59] R170,000 provided by Duke Alexander Petrovich of Oldenburg was spent on the conversion of the fort and procurement of new equipment for microbiological research. The construction of the anti-plague facility within the Fort was supervised by Aleksandr Aleksandrovich. Vladimirov and Simon-Leonard Konradovich Dzerzhgovskii, both employed at the Institute of Experimental Medicine in St Petersburg. The facility's first director was Vasilii Isaevich Isaev, who had worked with Koch and the German bacteriologist Richard Pfeiffer during the Hamburg cholera epidemic of 1892.[60] In 1901, the facility was named the Imperial Institute of Experimental Medicine's Special Laboratory for the Production of Anti-Bubonic Plague Preparations in Fort Aleksandr I (Osobaya laboratoriya Imperatorskogo instituta eksperimental'noi meditsiny po zagotovleniyu protivobubonnochumnykh preparatov v forte 'Aleksandr I').

Access to the Plague Fort was by a small ferry ship, *Mikrob* (The Microbe), which belonged to the Institute of Experimental Medicine. The fort incorporated research laboratories including containment labs, a crematorium and a science library. An array of different laboratory animals were housed at the fort including monkeys, camels, rabbits, guinea pigs, rats, mice and even reindeer. However, the key lab animal was the horse with a stable of sixteen animals being maintained at the facility for the production of plague serum. A small running track for the horses was installed in the courtyard and a special lift installed capable of carrying a single horse. In 1904, and again in 1907, there were two accidental outbreaks of plague within the facility, which resulted in the deaths of two scientists, Vyacheslav Ivanovich Turchaninov-Vizhnikevich and Emanuel Fedorovch Shreiber.[61]

The Plague Fort (Chumnoi fort) operated under the Special Commission for the Prevention and Fight against Plague in Case of Its Spread in Russia, known by the acronym KOMOCHUM.[62] The facility was given responsibility for all work connected with the study of plague and the production of anti-plague preparations and sera and also began the production of anti-cholera sera in 1905.[63] The operation of the Plague Fort was governed by a 'Codex of Governmental Measures Against the Introduction and Spread of Cholera and Plague within the Empire and Over Ground and Sea Borders', which was drawn-up in 1902. One of the articles of the codex stated that: 'the conduct of any sort of experiments or research into bubonic plague would be concentrated exclusively on the premises of the Fort of Tsar Alexander I at Kronstadt, and that these studies were prohibited in all other institutions of [St] Petersburg, in view of the danger they posed'.[64]

The Ministry of Internal Affairs allocated R60,000 for the maintenance of the establishment. During the period of its existence, the laboratory produced: 4,795,384 cubic centimetres of plague vaccine and 2,343,530 cubic centimetres of therapeutic anti-plague sera; and 1,999,097 cubic centimetres of cholera vaccine and 1,156,170 cubic centimetres of anti-cholera sera. Significant quantities of anti-typhoid and other sera were also produced.[65] The fort's staff also taught courses on the bacteriology of plague to government physicians in Kronstadt and St Petersburg.[66] The use of the Plague Fort is officially reported to have been discontinued when a new anti-plague centre, the Territorial Institute of Microbiology and Epidemiology of South East Russia (Kraevoi institut mikrobiologii i epidemiologii Yugo-Vostoka Rossii), was created in Saratov in 1918.[67] However, some of the fort's equipment appears to have remained in place in Kronstadt.[68] The fate of the pathogen collection maintained by the fort's laboratory is unknown.[69]

German and British intelligence reports of offensive BW experiments at the Plague Fort

Declassified reports produced by the British SIS point to the use of the Plague Fort for biological warfare research. A SIS report from January 1925 notes that Maslakovets was engaged in work on plague at the fort in

Kronstadt. It states that 'It is known for certain … that the cultures most suitable for the spread of plague have already been prepared and are kept at ALEXANDROV Fort near KRONSTAD [sic].'[70] By the winter of 1925, SIS was reporting that the main Experimental Station had been moved in its entirety from Fort Aleksandr I to the Kinburn Testing Station.[71]

A second report from September 1926 indicates that, by this time, Zlatogorov was leading research at Fort Aleksandr I aimed at developing strains of plague that remained viable when loaded into artillery shells, aerial bombs and other means of dispersal. In the same year, in addition to military funding, Zlatogorov is reported to have been allocated R120,000 from the budget of the People's Commissariat of Health for this research programme. One Dr Kazanskii was reported to be aiding him with his research at the fort.[72]

German intelligence independently identified the fort as a BW facility. According to Professor Heinrich Kliewe, a German BW specialist captured after the Second World War, in 1925 Zlatogorov was given an assignment to work on biological weapons. Work on anthrax, glanders and tuberculosis was conducted at both the Kronstadt fort and at Shlissel'burg (to the east of Leningrad).[73]

It is of considerable interest that both British and German intelligence, independently of one another, received reports of offensive BW work underway at the Plague Fort. A third intelligence organisation, the US Central Intelligence Agency (CIA), appears to have been unaware of the British SIS reports. It noted in an authoritative 1961 report on the Soviet BW programme that German intelligence officers believed that Soviet attempts in 1930 to develop biological bombs were supplemented by animal experiments at Fort Aleksandr I. It also indicates that 'Two former Russian residents also mentioned the [fort] as the site of possible BW work.' The report then states that:

> it is known that Kronstadt housed a plague laboratory from 1899 until 1918–1919, and that this installation was the forerunner of today's Scientific-Research Institute of Microbiology and Epidemiology of the Southeast USSR (Mikrob) in Saratov. A history of Fort Alexander's work indicates that it was the primary training centre for plague specialists in the USSR until the 1918–1919 transfer to Saratov. Aerogenic infection of laboratory animals with plague was studied as one phase of research.[74]

However, the report concludes that: 'No record exists of the period between 1919 and the alleged BW experimentation of 1930, and evidence to substantiate a BW mission at Fort Aleksandr I in more recent years has not been forthcoming.'[75]

Conclusions with regard to SIS reports on the BW research of Zlatogorov and Maslakovets

What then is the final conclusion with regard to the SIS documentation and its allegations concerning an early offensive BW programme in Leningrad? Certainly, if the intelligence is the result of a deliberate Soviet transfer of false information, then this would represent a highly sophisticated exercise in deceit. The SIS accounts are enormously detailed and fit with all the known facts that have since emerged concerning the lives of Semen Ivanovich Zlatogorov and Petr Petrovich Maslakovets. German intelligence separately identified this early programme but could only learn a few key facts concerning its operation.[76] In addition, it is evident that Zlatogorov, allegedly the lead scientist in the Soviet BW programme, is one of the only individuals in the USSR at this time to have the necessary skills and expertise to pursue such research. His role in conducting experiments and collecting strains during the October 1910 to February 1911 outbreak of pneumonic plague in Manchuria makes him uniquely qualified in this respect. That Zlatogorov was later to take charge of the Red Army's new Z.P. Solov'ev Institute of Prophylactic Sciences (Institut profil'akticheskikh nauk Z.P. Solov'eva or IPN)—see below—is further circumstantial evidence of military interest in his work. Zlatogorov, and indeed Maslakovets, are closely linked to the Military Medical Academy in Leningrad.

Why then did Zlatogorov not publish his research when he first believed he had discovered the causative organism of EL? This research could presumably have had a huge impact on global health and provided international acclaim for Zlatogorov. Was it the case that the Soviet authorities, recognising the potential military applications of the research, classified it as a state secret and prevented its publication?

The role of the Leningrad Military-Medical Academy in the biological warfare programme

The most significant military biological facility in Leningrad in the 1920s and through to the 1940s was the Military-Medical Academy

(Voenno-Meditsinskaya Akademiya or VMA). It embraced powerful R&D departments focused on microbiology and epidemiology staffed by a number of the leading scientists in the USSR. Alibek, the former first deputy head of Biopreparat, identifies the "Leningrad Military Academy"—presumably referring to the Military-Medical Academy—as the lead institution in the early Soviet biological warfare programme. Before examining Alibek's account in more detail, it is worthwhile taking a closer look at the history of this facility and the capabilities it had at the time.

Daniil Kirillovich Zabolotny, Zlatogorov and the Institute for Prophylaxis (IPN)

In December 1923, the Military-Medical Academy created its first department focused on microbiology and epidemiology, occupying twelve rooms in a former medical school. In May 1925, this department was transferred to the newly equipped Institute of Prophylactic Sciences—itself attached to the academy—where it occupied forty-two rooms on the third floor of the left wing of the building. The new institute constituted the core of military biological science at the Military-Medical Academy.[77] Its initial mission included research 'into the operation of modern gas masks in modern bacteriological warfare ... and counteraction measures in germ warfare'.[78]

One of the leading figures in the Military-Medical Academy's new institute was Academician Daniil Kirillovich Zabolotny (1866–1929).[79] Zabolotny was a prominent bacteriologist and epidemiologist. He had previously been arrested in 1889 for having participated in student demonstrations and expelled from the University of Novorossiysk in Odessa. In 1894, he graduated from the Department of Medicine of the University of Kiev..[80] By 1911, Zabolotny was a professor of bacteriology at the Medical Institute (St Petersburg) and chief of the Syphilogical Laboratory at the Imperial Institute of Experimental Medicine (St Petersburg). Zabolotny had an international reputation as a plague control expert and was chief of the Russian Commission for Plague Investigation in China (see fig. 11).[81]

Zabolotny's position in the new military institute is interesting and may conceivably point to a wider BW role. In his memoirs, Igor' Domaradskii suggests that Zabolotny may have been involved, at least tangentially, in a military BW programme. He notes that he was one of the first scientific researchers to accept the Soviet regime unconditionally. In 1918, at a conference on cholera called by the Petrograd Soviet of Worker, Soldier and Peasant Deputies, Zabolotny declared that he was placing himself and his expertise 'at the disposal of the working class'. On 9 March 1918, prior even to the formation of the People's Commissariat of Health, Zabolotny is reported to have submitted a plan regarding the use of the Plague Fort located at Kronstadt.[82]

During the Soviet period, Zabolotny was placed in charge of the Sanitary-Epidemiological Commission of the Main Military-Sanitary Directorate of the Red Army and was appointed a member of the Scientific Medical Council of the People's Commissariat of Public Health (Narkomzdrav).[83] Domaradskii makes the following observation about Zabolotny:

> in the light of his ideological adherence to the new political regime, I cannot rule out the possibility that D. Zabolotnij … may have been involved, at least tangentially, in the initiation of the development of biological weapons in the USSR. During the first years of the Soviet regime, D. Zabolotnij was probably the country's only researcher who knew particularly dangerous infections, including plague, first-hand, so his knowledge would have been invaluable in the early development of an offensive programme.[84]

Domaradskii may have been right about Zabolotny, but he was certainly wrong about him being the only scientist with first-hand experience of plague. As demonstrated above, Zlatogorov was the leading Soviet expert on a particularly deadly form of pneumonic plague, and he had played a major role, alongside Zabolotny, in its eradication in Manchuria in 1911. In 1929, it was none other than Zlatogorov who was appointed director of the Institute of Prophylactic Sciences. The secret SIS reports referred to above identify Zlatogorov as one of the leading figures in an early offensive BW programme based primarily in Leningrad. If true, his appointment as director may therefore signify that the institute was now being assigned a leading BW role. Zlatogorov himself noted that IPN was to focus on issues 'left unresolved in the area of chemical and bacteriological warfare'.[85] However, he did not live to follow through with his plans. As noted above, in December 1930 he was placed under arrest by the OGPU and subsequently died in hospital on 17 March 1931.[86]

Alibek and the Military-Medical Academy's alleged BW programme focused on Typhus

Ken Alibek, who as Kanatzhan Baizakovich Alibekov was the first deputy director of Biopreparat, places the Leningrad Military-Medical Academy (VMA) at the very centre of the early Soviet biological warfare programme. He indicates that, in 1928, the Revolutionary Military Council signed a secret decree to develop a battlefield weapon based on *Typhus rickettsiae*. He suggests that Red Army commanders were influenced in their selection of this organism by the 1918–21 typhus epidemic that caused numerous casualties during the Russian Civil War. In addition, no vaccine existed at this time to protect against the disease. Alibek reports that he learnt of the 1928 decree from an old set of reports held at the USSR Ministry of Defence. These were incomplete, and he was able to learn additional details by consulting veterans of the Soviet BW programme who had themselves learnt the facts from an older generation of scientists.[87]

Alibek reports that the Leningrad Military Academy was used as a research base for the programme focused on typhus. He surely is referring here to the Leningrad Military-Medical Academy (VMA). Be that as it may, small teams of military and OGPU scientists are reported to have attempted to cultivate *Typhus rickettsiae* in chicken embryos. Thousands of eggs were delivered to the VMA each month for this purpose. By the 1930s, 'the Leningrad Academy had produced powdered and liquid versions of typhus, for use in a primitive aerosol'.[88]

A smoking gun? British secret intelligence reports of typhus BW tests in the outskirts of Moscow, June 1924

The only evidence in support of Alibek's account of a major Soviet BW programme focused on the weaponisation of *Typhus rickettsiae* is provided by the archives of the British SIS. It reported on BW experiments that had been undertaken in June 1924 near Moscow's L.D. Trotsky Central Aerodrome (also known as the Khodynka Aerodrome). According to the SIS, bacteriological bombs containing *Typhus rickettsiae* had been invented by the Soviet scientists Dr N. Vlasevskii and Dr Dengin. They had designed bombs for dropping from aircraft and for use in deliberate contamination of water supplies. The inventions were then submitted to the Higher Military Chemical School and the Higher Military

Scientific Chemical Commission attached to the Revolutionary Military Council (RVS).[89]

The RVS's Higher Military Scientific Chemical Commission then appointed a sub-commission to conduct research and experiments on the bombs. The sub-commission was composed of the following scientists: Professor Popov (chairman), Dr N. Vlasevskii, Dr Vigodtchigov, Dr Dengin, Dr Batashev, Dr Yakovlev and Dr Smislovskii. The experiments with the *rickettsiae*-loaded bombs were conducted by the Higher Military Chemical School in the presence of the sub-commission members. The first test was conducted on 12 June. An area of 127.8 square metres was fenced off and forty dogs released into the enclosed space. Four bombs charged with *Typhus rickettsiae* were then dropped from low altitude. The bomb was:

> filled with a porous mass in which were placed a large quantity of small glass capsules containing typhus bacilli … According to the inventors' theory, the slightest explosion causes the shell of the capsules to burst and the substance settles on the inner core of the bomb, the slightest wound being sufficient to secure infection.

Fourteen dogs are reported to have been injured during the course of the experiment, but none of the animals became infected with typhus. The sub-commission later discovered that 'the chemical reaction set up by the explosion paralysed the bacteria thus preventing infection'.

On 23 June, a second test was undertaken, but on this occasion changes in the explosive material were instituted and less of it was employed. This time, some five bombs were dropped with eighteen dogs being injured, but again no infection resulted. No further experiments were undertaken with the Vlasevskii/Dengin bombs at this time, and the sub-commission began work on attempting to resolve the problems encountered.

Additional experiments were then conducted with the 'hydrostatic bombs' by the Higher Military Chemical School on 30 August and 5 September. Six bombs containing small glass balls charged with cholera bacilli were dropped into a small pond measuring 8 by 3 metres. The force of the explosion caused the balls to break, releasing the bacteria into the water. Another experiment using eight bombs containing cholera bacilli was undertaken on 5 September, again with satisfactory results. The sub-commission was able to inform the RVS's Higher

Military Scientific Chemical Commission 'that this type of bomb was quite suitable for poisoning rivers, and waterways on a large scale'.

It is interesting to speculate whether the experiments described by the SIS documents were the forerunner of a more ambitious attempt to weaponise *Typhus rickettsiae*. What is interesting is the fact that Dengin, one of the co-developers of the bombs, appears to have been based in St Petersburg, where he is reported to have personally supervised the manufacture of both types of bomb at the Red Chemist Chemical Factory (Khimicheskii zavod 'Krasnyi khimik').

SIS reports that in the winter of 1925 a Special Testing Commission under the leadership of Zlatogorov undertook trials of bombs containing *Typhus rickettsiae*. The bacteria were spread into finely chopped silk threads covered with a film of mineral oil. He was assisted in this work by Dr Chaimovich.

Expansion of BW programmes pursued by the Military-Medical Academy: the alleged Solovetsky Island laboratory

Alibek reports an expansion of the BW programme pursued by the VMA. He claims that, by the mid-1930s, the VMA had despatched a group of scientists and their equipment to the remote Solovetsky Island in the White Sea, where they are reported to have been based at a large laboratory compound built by political prisoners held captive on the island. According to him, the scientists pursued research on typhus, Q fever, glanders and melioidosis. Alibek suggests that experiments may have been undertaken on prisoners. He describes summary reports compiled by the Ministry of Defence referring to several dozen cases of melioidosis from that period. Alibek then states:

> The material I saw was intentionally vague as to whether humans were involved, but the way the case reports were arranged—with nineteen in one group, eleven in another, and twelve in yet another—suggested an irregular pattern not usually associated with animal experiments. And the symptoms described could only have been experienced by human subjects.[90]

Again, some considerable caution should be exercised in accepting Alibek's account, which is not corroborated by any other sources. He also desribes accidents associated with the programme and, in the late 1930s, twenty workers are reported to have become infected with glanders during experiments.[91]

Solovetsky Island, also known as Bolshoy Solovetsky Island, is the largest island of the Solovetsky Island archipelago. It was the location in the 1920s and 1930s of the Solovki prison camp, which appropriated many of the buildings belonging to the Solovetsky Monastery, and served as a prototype of the camps of the GULAG system. In 1933, it was absorbed into the Belomorsko-Baltiiskii camp and then in February 1937 transferred to the NKVD when it became known as the Solovetsky Prison of Special Significance (Solovetskii Lager' Osobogo Naznachenia or SLON—*slon* also means elephant in Russian). The number of prisoners on the island in January 1931 is estimated at 71,800. A prisoner held within SLON in late 1936 provides a chilling description of the guards and their attitudes to their political captives:

> They are hand-picked from the ranks of the regular NKVD troops ... The Solovetsk Political isolator is the pride of the NKVD. The Chekists here draw the highest salaries. Service in Solovetsk is considered a great honour. This is the oldest Soviet political isolator. The guards here have their traditions—vigilance, hatred of political prisoners, ability to act decisively and ruthlessly to stamp out trouble.[92]

One eye-witness to the activities of SLON was none other than Aleksandr Aleksandrovich Baev, a leading Soviet bioscientist, who was himself to play an important role in the renewed offensive biological warfare programme launched by the USSR in the 1970s. Writing in 1995 after the collapse of the Soviet Union, he describes how he was arrested and charged with fabricated offences in 1937. He was transported to the main Solovetsky island, which he describes as:

> very impressive. It was night, the air was still, the moon bright and full, and the coarse pebbles crunched under our feet. We walked along, escorted by a large convoy and angry dogs. In front of us, out of the darkness, emerged the ancient walls of the Solovetskii Kremlin, built of huge, glacial boulders, and stocky, peaked towers.

However, while Baev was able to make good use of the excellent library the Solovetsky prison had accumulated, he appears to have had no knowledge of any BW research underway at the time, either on the main or adjacent islands.[93]

Alibek in fact is rather vague concerning the location of the alleged BW facility. If it did exist, then one might also conceivably consider other sites in the Solovetsky Islands archipelago. Anzer Island, for instance, occupies an area of 47 square kilometres and was always subject to restricted access. Even within the Solovki it was known as a Top Security Territory. A wide range of prisoners were sent here, many of whom were politically and socially viewed as dispensable. Conditions for prisoners on this island were very poor and the mortality rate quite high.[94] Anzer Island was also the location from the end of the 1920s of a small hospital, situated on the site of the Golgotha Crucifixion Hermitage, which might potentially have been utilised for secret work.[95]

Alibek's account of a BW programme pursued by the VMA on the Solovetsky Islands is undoubtedly intriguing but lacks any corroboration from historical sources. Nothing is known of the documentation to which he reports he had access or of the 'old-timers' who provided him with additional information. The lack of any supporting evidence means that it is not possible to subject his account to much additional analysis. There may or may not be additional papers relating to this alleged programme in military or secret police files. It is possible that new information will emerge in time that will allow a more definitive judgement to made regarding the veracity of Alibek's account.

The absence of the Leningrad strand of the BW programme in Russian historical accounts: A loss of institutional memory?

There is then some considerable evidence that a Leningrad strand of Stalin's BW programme did in fact exist. Key scientists, such as Zlatogorov and Maslakovets, have been identified, as well as the lead agencies (the RSFSR People's Commissariat of Health and the Red Army) and the individual facilities (including the Plague Fort and the Military-Medical Academy). So it is at first sight puzzling as to why this strand has been completely omitted from official accounts. However, it should be recalled that the two lead scientists managing the research were both suddenly arrested by the security services in the winter of 1930 and spring of 1931 and died shortly thereafter. They were therefore unable to contribute any oral or written history of their activities. In the case of Velikanov, he had the good fortune to have a son who, over very many years, pursued the Soviet authorities and forced them to rehabilitate his father and restore him to his central place in the account of Stalin's programme. Demikhovskii, another key player, also survived the purges and wrote-up an account of the BW research effort. Zlatogorov and Maslakovets, meanwhile, belonged to an earlier generation of scientists. It was to be another two decades after their demise before Stalin released his iron grip on the country. The original experimental records and related documentation is likely to have been seized and stored away in specialised secret archives. It may very well be the case that all institutional memory of this strand of the programme, possibly a highly secret and compartmentalised component of the overall effort, was lost. It is to be hoped that the resurfacing of the SIS accounts of the early Soviet BW programme and the leading role of Zlatogorov and Maslakovets may prompt Russian historians to re-examine the historical archives and to seek additional corroboration of the British and German secret intelligence reports.

8

FROM FLANDERS TO GLANDERS

SOVIET MILITARY-VETERINARY BW PROGRAMMES

There is substantive evidence of the long-term integration of veterinary microbiological facilities within the USSR's biological warefare programmes. The initial impetus to this process were the concerns of the early Soviet regime over BW sabotage attacks by Germany in the First World War. Anthrax (*B. anthracis*), which had been employed to infect horses and cattle in Russia and the same organism, together with *P. mallei* (the causative agent of glanders), was used in attacks against cavalry and draft animals in Romania, the United States and Argentina.[1] On 6 December 1918, the Revolutionary Military Council (Revvoensovet) issued Order No. 342, which established, under the Main Military-Medical Administration, a Provisional Scientific Committee focused on preventative measures against the infection of the human population with glanders.[2] Subsequently, on 8 December 1918, Revvoensovet issued Order No. 368 regarding the establishment of a Central Veterinary Bacteriological Laboratory (Tsentral'naya veterinarno- bakteriologicheskaya laboratoriya) under the Red Army's Main Military-Veterinary Administration.[3] This military laboratory was located on Ulitsa Arbat in Moscow.[4]

The main role of the veterinary laboratory was concerned with the protection of the health of hundreds of thousands of horses in use by the

Red Army. In this early period, the Central Veterinary Bacteriological Laboratory's research was primarily focused on glanders, but there were also programmes underway on anthrax and other infectious diseases.[5] One of its key roles at this time was to train workers in the eradication of glanders. Interestingly, the Soviet focus on glanders continued through to the Second World War when military trials of this agent were conducted on Vozrozhdenie Island in 1942.[6] Allegations have also been made that this agent may even have been employed in operations against the mujahidin in Afghanistan.

A branch of the Red Army's veterinary facility was created in 1918 at a confiscated estate at Vlakhernskoe-Kuz'minki, Moscow. The Kuz'minki branch was in fact a proving ground, or Polygon as the Soviets called it, which occupied an area of 1.7 hectares and was protected by a wooden stockade and guards. It was intended for 'the study of especially dangerous infectious diseases of agricultural animals'. The proving ground is known to have been used for experiments to determine the survival rates of horses when exposed to anthrax. It was in use until the beginning of the Second World War when it was evacuated in the face of advancing German forces.[7]

The Central Veterinary Bacteriological Laboratory was renamed the Central Microbiological Station (Tsentral'naya mikrobiologicheskaya stantsiya) in January 1921. The station was itself reformed as the Veterinary Microbiological Institute (Veterinarnyi mikrobiologicheskii institut) in Leningrad in 1924. The latter facility was renamed as the Red Army's Veterinary Scientific-Research Institute (Veterinarnyi NII Krasnoi Armii) in 1929.[8] The institute is at this time reported to have occupied a huge building dating from the end of the eighteenth century or beginning of the nineteenth century, which was based at 88 ulitsa Moika. It adjoined the left wing of the Yusupov Palace—the site of Grigori Rasputin's murder in the early morning of 30 December 1916.[9]

The Soviet authorities considered the location in Leningrad of a military research facility working on highly dangerous pathogens to be undesirable and initiated a search by a special commission for a new site for the institute. According to S.B. Logginov, a veterinary service colonel, the commission made several expeditions to locations in the Moscow region but failed to find an appropriate site. A suitable location was eventually found near the city of Zagorsk (present-day Sergiev Posad) when the commission came:

> to rest from their bumpy journey [the road is reported to have been cobbled at this time] in a bright silver birch grove, bathed in sunlight … The quiet, warm weather, the smell of summer grasses and the song of nightingales softened the souls of the commission members. They had a good snack. The place was suitable both for the research centre and stables and for horse pastures. The decision was unanimous: the institute would be sited here.[10]

Construction of the new military veterinary facility near Zagorsk began in 1936. Collective farm (kolkhoz) workers were drafted in by the Soviet authorities from the adjoining Ryazan and Kaluga oblasts. By 1938–9, the following essential infrastructure had been created: Building Number 9 for Scientific-Research Work; Building for Especially Dangerous Agents; Dissecting Room Number 18; stables; an artesian well and a water-tower with pumping station; sewerage system; two buildings as accommodation for the senior staff (comprising twenty individual apartments); several wooden barracks; a telephone exchange with twenty numbers; and a small wooden bath house. The Red Army's Veterinary Scientific-Research Institute was to occupy the site only until the autumn of 1941 when it was forced to evacuate in the face of rapid advances by the invading German forces.

The BW programmes pursued by its military veterinary facilities may conceivably have been viewed by the Soviet military as a means of allowing it to bypass existing international prohibitions on the use of offensive biological weapons against human targets. Certainly, it appears to be the case that the German General Staff considered its own First World War programme of biological sabotage directed against military supplies rather than human targets to be consistent with the 1907 Hague Convention. In a similar way, the United States is reported to have concluded during the Second World War that the use of anti-crop agents against Japan would be legal since it merely constituted an extension of accepted practice.[11]

Civil veterinary facilities engaged in BW research

One of the key civil veterinary facilities engaged in BW research appears to have been the All-Union Institute of Experimental Veterinary Science (Vsesoyuznyi institute eksperimental'noi veterinarii or VIEV). It was created on the basis of Russia's first veterinary laboratory on 10

October 1917 in Petrograd by the Russian Provisional Government. In 1918, during the Russian Civil War, the institute was moved from thence to Vlakhernskoye-Kuz'minki, Moscow. As a result of a fire at the site in 1915 or 1916, many of the buildings had been left in a ruined state. In 1938, a branch laboratory of VIEV was created on Lisii Island for the study of dangerous pathogens, and this appears to have been the institute's base for BW experiments.

Anti-livestock BW facilities on Lisii Island

One of the most significant veterinary facilities with regard to the Soviet BW programme was not part of the Red Army's Main Military-Veterinary Administration at all. In 1938, a branch laboratory of VIEV was established on Lisii Island.[12] The island is located on Vyshnevolotskoye reservoir, close to the town of Vyshny Volochek, located 119 kilometres north-west of Tver (formerly known as Kalinin). Vyshny Volochek is located on the strategic Moscow to St Petersburg railway. The island is reported to be wooded and occupy an area encompassing some 1,500 acres. The facility was apparently created shortly after the authorities issued an official warning encouraging Soviet veterinary organisations to develop countermeasures against anti-livestock agents. The military facilities on nearby Gorodomyla Island are reported to have been used a model for the construction of the laboratory. US intelligence noted that its location near Vyshny Volochek did not provide the degree of seclusion ideal for offensive BW activities.[13]

The first main focus of the Lisii Island facility appears to have been on foot-and-mouth disease, presumably including research tasks that had originally been performed by the FMD research laboratory operating from 1932 to 1935 on Gorodomyla Island. The Red Army had subsequently taken control of the FMD facilities on Gorodomyla for use in its own offensive programme. Despite Gorodomyla's historical focus on the FMD virus and the fact that it was a mere 65 miles from Vyshny Volochek, US analysts could find no evidence of any cooperative research between the Red Army personnel and those based on Lisii Island during the three-year period of their coexistence. They concluded that the programmes at the two sites were being deliberately compartmentalised by the Soviet authorities.[14]

In 1956, US intelligence concluded that the VIEV branch on Lisii Island 'had almost certainly been involved in both offensive and defensive anti-livestock BW research'. Its operations had apparently included the acquisition of foreign strains of the foot-and-mouth disease virus and may have included studies on the experimental transmission of the infection in domestic animals. Such operations could potentially signal an early attempt to screen candidate agents, but they are also essential stages in the development of effective vaccines used in defensive BW. US intelligence therefore concluded that 'Such effort can actually be construed as either offensive or defensive, depending upon the nature of ancillary information.'

The development of civil capacity for the large-scale manufacture of anthrax vaccine

Historical background: the Tsenkovskii vaccine

The first Russian live vaccines against anthrax (caused by *Bacillus anthracis*) were developed by Lev Semenovich Tsenkovskii using a method elaborated by Louis Pasteur.[15] Like Pasteur's, Tsenkovskii's vaccine was in fact a two-stage vaccine. The primary inoculation used subcultures of *B. anthracis* cultures that had been incubated at 42.5°C for twelve days. For the second, vaccine sub-cultures (based on strains 71/12 and M/71) were taken after six days heating and were consequently rather less attenuated.[16] The vaccine was tried experimentally in the field in November 1884 on a farm in Kherson oblast' with complete success.[17]

The outcome of the trial led to the approval of Tsenkovskii's vaccine, which, during the period 1885 to 1942, was the only one in use in Russia (and subsequently the Soviet Union) for the vaccination of agricultural animals.[18] One of the first industrial production sites was at the Kursk Biofactory, which was commissioned and began output of the anthrax vaccine in January 1896. Later, in 1931, this technology was transferred to the Orel Biofactory, which continues to produce preparations against the disease to the present day.

The commissioning of industrial production of Tsenkovskii's vaccine at Orel in 1931 and the subsequent wider availability of this preparation led to a significant decrease in animal mortality from anthrax. The number of cases (at least 95 per cent of animals died within a month) in Soviet livestock decreased from 20,694 in 1930 to 1,457 in 1933.[19] A bacteriological station in Orel had in fact been built by the Bolsheviks in 1918 on the site of a former country estate.[20] This was then reorganised as a Veterinary-Bacteriological Institute. It was on the basis of this latter facility that the Orel Biofactory itself was built in 1930.[21] The factory was located some 4 kilometres outside of the small settlement of Nikulichi, which itself is located around 2 kilometres to the north-west of Orel. Its main task was to produce vaccines and sera against highly infectious diseases and in particular anthrax. It produced a range of products for the diagnosis, prophylaxis and treatment of anthrax, including vaccines, sera, antigens and globulins.

Anthrax in Siberia: the Tobol'sk Biofactory

Anthrax was known in Russia as the 'Siberian Pest' because of the frequent devastating outbreaks that affected horses, cattle and people in the region. Johann Georg Gmelin is reported to have first described the disease on the Irtysh River in 1740, since when it has been known as a permanent scourge of Western Siberia, breaking out annually in the summer months. In June and July 1821, for example, 100 out of a total of 1,000 horses in Tobol'sk had become infected with anthrax, with thirty dying as a result.[22] An outbreak in Tobol'sk in 1864 is reported to have killed nine men, 356 cattle and 4,270 horses.[23] In 1895, a Provincial Veterinary-Bacterial Laboratory was created in Tobol'sk (Tyumen oblast') in Siberia, located at the confluence of the Tobol' and Irtysh Rivers. In 1911, there was a mass death of deer caused by anthrax, and the Tobol'sk laboratory sent out three expeditions to the region in 1912, 1913 and 1914. The first attempts to immunise the deer against anthrax were made at this time. In 1920, during the Soviet period, the laboratory was reorganised as the Veterinary-Bacteriological Institute (Veterinarno-Bacteriologicheskii Institut).[24]

In December 1931, a biofactory was formed on the basis of the research institute.[25] It is reported to have produced both anthrax vaccine and immunoglobulins.[26] The biofactory maintained a herd of up to 500 horses for the manufacture of these preparations. The factory was subsequently closed after it went bankrupt in 1997.[27] It appears to have left a potentially hazardous legacy behind. Around 5,000 horses infected with anthrax are reported to be buried in Tobol'sk at a site located around 50 metres from the Irtysh River. In 2004, the local authorities were engaged in a project to strengthen the banks of the river where it came close to the burial site. In February 2004, Beniyamin Cherkasskiy, of the Central Research Institute of Epidemiology in Moscow, noted that:

> The Tobolski gravesite is the result of activity at a nearby factory involved in the production of veterinary prophylactic drugs, including vaccines against anthrax. Unfortunately despite sealing off the toxic waste storage facility with concrete, which provides isolation from the surrounding environment, the factory does not have any resources for the radical disinfection of the waste.[28]

Additional sites for production of Anthrax vaccine in the USSR

In May 1924, an anti-plague station was created at Kashintsevo, near Shchelkovo, 22 kilometres north-east of Moscow. The station belonged to the VIEV. Its main focus at this time was on products to counter swine diseases and especially classical swine fever, severe outbreaks of which had recently had a devastating impact on central Russia. By 1929, the facility employed thirty personnel.[29] The station was used as the basis for the creation in 1930 of the Kashintsevo Biofactory, which continues to operate today as the Shchelkovo Biocombine.[30] The construction of the facility was fully completed in 1937, and it then began production of a range of veterinary vaccines.[31] The Kashintsevo facility may have been subsequently used by the Red Army for the production of its anthrax vaccine.

Another major anthrax production site was the Alma-Ata Biocombine (Alma-Atinskii biokombinat) in Kazakhstan. The plant was founded in 1931 and was the second largest veterinary vaccine facility in the Soviet Union, with its production plants eventually occupying an area of 30,000 square metres.[32] Total vaccine output before the collapse of the Soviet Union was recorded at more than one million litres of liquid preparations and 511,700,000 doses of dry preparations.[33] Facilities at the plant for production of bacterial vaccines included four 250 litre fermenters, two 1,000 litre fermenters and three 3,500 litre fermenters together with twelve vertical high-capacity centrifuges and fifteen freeze driers (with 1,500 x 15 cc vials). Anthrax production at the Almaty Biocombine was probably enormous, with two preparations being manufactured, the *STI* live anthrax vaccine and later the *VNIIVViM* live anthrax vaccine.[34] Alibek reports that the Almaty Biocombine eventually became a reserve mobilisation facility for the production of biological weapons, primarily anthrax.[35] It may also be the case that the Soviet Union maintained additional veterinary microbiological facilities in a state of mobilisation preparedness, with tasks connected with BW attacks on human and/or animal targets.

9

ON THE BRINK OF BACTERIOLOGICAL WAR

STALIN'S BW PROGRAMME AND THE SECOND WORLD WAR

The build-up to war on the Eastern front

During the 1930s, a series of reports generated by both German and Soviet intelligence fuelled increasing alarm with regard to the perceived BW capabilities allegedly being developed by their potential opponents. These concerns were only to intensify during the ensuing period of great upheaval with Hitler assuming power in Germany and Stalin unleashing the Great Terror.

German fears regarding Soviet BW capabilities and intentions were first provoked with the publication in 1925 of an article in the newspaper *Rzeczpospolita* that detailed how a Russian scientist had developed an aircraft-borne bomb that could be used for the dissemination of bacteria. On 28 November 1928, as detailed above, German intelligence issued a report, 'Bakterienbomben und deren Herstellung in Russland' (Production of bacterial bombs in Russia), on the biological warfare activities of the Zlatogorov–Maslakovets Laboratory in Leningrad. In 1936, one of the Red Army's key medical journals, *Voennoe Sanitarnoe Delo*, published an article describing the use of BW agents against selected targets, including the civilian population.

The Soviet military were also in receipt of a steady stream of intelligence relating to Germany's development of biological weapons. In 1930, Voroshilov, at this time holding both the posts of people's commissar for military and navy affairs and chairman of the Revolutionary Military Council of the USSR, received a disturbing new intelligence report on the German development of biological weapons, 'Information on Offensive and Defensive BW Measures in Foreign Armies: England, Germany, France, Yugoslavia'. The report stated that:

> The work on utilization of bacterial material performed in Germany is in the stage of field testing … An automatic device has been developed and shows good results in field testing to drop rats from unmanned balloons in the enemy rear … The next method of utilizing bacteria is to employ shells … Field experiments with … shells conducted in 1930 were a success. Experiments were made … with anthrax spores and glanders bacteria.[1]

In 1933, Velikanov, head of the Red Army's lead BW facility, the Military Scientific-Medical Institute (Vlasikha) and the chief BW scientist in the Soviet Union at this time, paid lip-service to the official Soviet line on biological weapons. He wrote an article in the *Soviet Military Encyclopaedia* in which he described biological warfare 'as a novel type of warfare prepared in bourgeois countries'. He also noted that Stanley Baldwin, a key figure at this time in the UK's National Government, had stated that 'research activities have to be carried out in the field of bacteriological warfare'.[2]

In 1938, Voroshilov, by now a marshal of the Soviet Union and people's commissar of defence, issued a stark warning to any country contemplating the use of biological weapons against the USSR:

> Ten years ago or more the Soviet Union signed a convention abolishing the use of poison gas and bacteriological warfare. To that we still adhere, but if our enemies use such methods against us, I will tell you that we are prepared—fully prepared—to use them also and to use them against aggressors on their own soil.[3]

On a war footing: the appointment of Lavrentiy Beria

By 1939, as the USSR went on a war footing, the Soviet leadership is reported to have been convinced that 'BW preparations were pushed to such a degree of development in the "imperialistic and fascistic countries" as to make their use, in case of an emergency, a foregone conclusion.' As a result, Stalin ordered an acceleration of BW preparations with instructions to 'put to intensive practical use what was found earlier'.[4] In the same year, Stalin appointed his fellow Georgian, Lavrentiy Pavlovich Beria, the head of the People's Commissariat of Internal Affairs (NKVD), in overall command of the country's biological warfare programme. Beria is reported to have placed bioweapons work under close scrutiny and required that reports be sent to him directly by the directors of facilities.[5]

There is some indication that by 1940 biological weapons had been assigned some prominence in Soviet military doctrine. In Marshal Tukhachevsky's ambitious new deep operations doctrine, devised in the 1930s for mechanised warfare, a key role had already been designated for armoured units in combination with air power, but he had also 'integrated chemical warfare into this vision as well'.[6] Tukhachevsky is known to have visited the Red Army's BW facility at Vlasikha no fewer than three times, and before his arrest, brutal torture and execution in 1937, he was probably one of the key advocates for the integration of biological warfare into Soviet military doctrine.

It is interesting that German intelligence later learnt of an alleged Soviet military BW course, presumably organised by the Red Army's General Staff, which they believed had been held in Moscow in 1940. During the lectures on all aspects of the offensive deployment of biological weapons, there was reportedly a major emphasis on training, estimating a requirement for around 5,000 to 6,000 bacteriological commissars with an array of training aids, including books and films. The lecturers allegedly called for the immediate use of BW agents upon the outbreak of war with the object of striking 'at the heart of the hostile country, at its centres of population and industries, at the nodal points of its commerce, its railways and the waterways. This may knock the enemy's advance out of gear.' With regard to the later campaign,

> BW agents may be used without any regard being given to its effect on our own, in the course of the campaign or in the case the enemy has already succeeded in employing it in our own land … The country may be defended by 'massive' or 'wholesale' contamination with a defensive material, e.g. anthrax, in order to impede or stop the advance of the foe.[7]

One should, however, be extremely cautious in accepting this German version of events since there is no evidence that a large-scale biological sabotage campaign of this kind was ever implemented by the Soviet Union.

One of the most significant events in the context of Soviet BW preparations at this time concerns a meeting held by Stalin in his Kremlin office with senior military chemical–biological personnel.[8] It took place on 1 April 1941, just before the outbreak of war on the Eastern front, The most senior attendee was Major-General Petr Gerasimovich Mel'nikov, who had headed-up Fishman's former department, the Red Army's Administration of Military-Chemical Defence, since 15 March 1939. He was accompanied by Colonel Mikhail Mikhailovich Faibich, who was a senior officer of the Sanitary-Technical Institute, at this time based on Gorodomyla Island. In the wake of Stalin's decapitation of the senior management of the Soviet BW programme, Faibich was one of the few senior experts still in place at STI. No record of the subject matter of the meeting in Stalin's office has ever been made public. It appears conceivable that the two officers attended the meeting in order to provide the country's leader with a full overview of the Soviet Union's military and chemical biological capabilities at this time. Presumably, given the background of acute international tension, Stalin was fearing, or potentially preparing for, the launch of a biological or chemical war.

On 23 May 1941, just a few weeks after the meeting in Stalin's Kremlin office, Vsevolod Nikolaevich Merkulov, the people's commissar of state security, issued a warning regarding the employment of bacteriological sabotage by the German and Japanese intelligence services. He then implemented a number of measures, codenamed *Yurta*, to counter this perceived threat. These included the imposition of tighter control over personnel employed within institutions working on viruses or toxins, the arrest of anyone previously convicted of bacteriological sabotage and an emphasis on the acquisition of intelligence regarding the feasibility and use of biological warfare from foreign legations based in the USSR.

Constraints on the use of biological weapons

At the onset of war, both the USSR and Germany were bound by the 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare—the Geneva Protocol. The Soviet Union acceded to the Geneva Protocol in 1928 with the reservations that:

> 1. The said Protocol only binds the Government of the Union of Soviet Socialist Republics in relation to the States which have signed and ratified or which have definitely acceded to the Protocol and 2. The said Protocol shall cease to be binding on the Government of the Union of Soviet Socialist Republics in regard to any enemy State whose armed forces or whose allies *de jure* or in fact do not respect the prohibitions which are the object of this Protocol.

Similar reservations had been made by France two years earlier.[9]

Germany, meanwhile, unconditionally ratified the Geneva Protocol in 1929. Germany's policy during the war with regard to the development and/or offensive use of biological weapons was in fact governed by Hitler's prohibition on such activity at the onset of conflict. He ordered at that time that 'no work concerning the offensive aspects of biological warfare would be done in Germany'. In the early months of 1942, Professor Kliewe, head of a department in Berlin working on BW, was informed by the surgeon general that Hitler had issued a strict order that on no account was any work to be done on preparing for offensive BW. Such was his opposition that the German leader became very annoyed when he learnt that any work at all was being done on the subject.[10] Even though in May 1942 Hitler was informed by the Army High Command of alleged biological warfare activities by the enemy, he ordered 'that no preparations for bacterial warfare are to be made by us'. Rather, extreme efforts were to be undertaken with respect to measures against possible enemy attacks. The restriction to defensive preparations alone was reiterated at several points during the war, most notably in July 1942 and March 1943. The reason for Hitler's prohibition on offensive BW is unknown. Geissler speculates that it 'stemmed from fear of Allied retaliation—fed by reports of their biological warfare programmes, a reluctance to use poisons in combat because of his World War I mustard gas injuries, a desire to abide by the Geneva Protocol in the interests of mutual deterrence, or his phobia for bacteria'. Hitler appears to have wavered with regard to his commitment to the Geneva Protocol only in the last months of the war.[11]

Operation Barbarossa and the threat to the Soviet Union's BW facility at Gorodomyla

On 22 June 1941, Nazi Germany commenced Operation Barbarossa—the invasion of the Soviet Union along a 2,900-kilometre front. Over the next three months, there were a series of resounding German victories with the occupation of Ukraine, Moldova and Belarus, and the besiegement of Leningrad. On 2 October, the Germans launched Operation Typhoon focused on the capture of Moscow. By 17 October, the Wehrmacht had occupied the city of Kalinin (since renamed as Tver) to the north of the Soviet capital. German forces now threatened to capture both the town of Ostashkov and the islands located on Lake Seliger. On 25 September, the local authorities in Ostashkov were ordered to evacuate all industrial equipment from the town to Beliy Gorodok. At some point around this date, in the face of the rapid German advance, the decision was taken by the Soviet high command to evacuate the Sanitary-Technical Institute (STI) from Gorodomyla Island.[12] The facilities at the site are then reported to have been subject to partial destruction.[13] By 1946, all traces of the facility had been removed, with a report stating that 'the only indicators of earlier experimentations were said to be old animal cages scattered over various parts of the island'.[14] Ostashkov and Gorodomyla Island were ultimately in fact never occupied by German troops but until 1943 remained in the immediate vicinity of the front lines. On cessation of hostilities, the island was used as a base for a missile research station, with German experts from Peenemunde arriving at the site.[15]

Fedorov contends that the STI was evacuated in 1942 further south along the Volga River to Kuibyshev (since renamed as Samara) in the south-eastern part of European Russia.[16] He provides no evidence for this assertion, although it is plausible that the facility was relocated to a city where other key military plants were evacuated. A key example is the Voronezh Aircraft Factory, which was evacuated to Kuibyshev in October 1941 and then focused on production of Il-2 ground attack aircraft.[17] The CIA's authoritative 1961 report on the Soviet BW programme discusses the possibility that STI was initially relocated to Kuibyshev but is also ready to concede that it is conceivable that 'STI was shifted from Gorodomyla Island directly to the city of Kirov without an interim period of activity in Kuibyshev, or with only a short stay, at best.'[18]

Given the lack of historical sources offered by Fedorov, and the lack of clarity from other sources, recourse must be made to official Russian accounts, which assert that STI was evacuated to Saratov, a major port on the Volga River located upstream (north) of Volgograd.[19] An eyewitness account by Colonel Chalisov, a former scientist employed at STI, also confirms that he and his colleagues were transferred to Saratov.[20] It is conceivable that this city was selected because it was the location of the Mikrob Anti-Plague Institute, one of the Soviet Union's key research institutes focused on highly pathogenic diseases. The unprecedented speed and progress of the Wehrmacht's advance caught the Soviet military authorities unaware. By the late summer of 1942, the German offensive to capture Stalingrad had begun, using the German 6th Army and elements of the 4th Panzer Army. The STI was once again under the imminent threat of capture.

It is against this background that Colonel-General Efim Ivanovich Smirnov, head of the Red Army's Main Military-Sanitary Administration (Glavnoe voenno-sanitarnoe upravlenie Krasnoi Armii), made a dramatic intervention. In the spring of 1942, desperate to avoid the loss of the STI at all costs, Smirnov had to personally win Stalin's approval for a second evacuation of the facility. In September 1942, the State Committee for Defence ordered the further relocation of the STI to Kirov, located some 896 kilometres north-east of Moscow on the Vyatka River.[21]

The German threat to military veterinary facilities

The first of the Soviet Union's military biological facilities to be evacuated in the face of the German advance was the Red Army's Veterinary Scientific-Research Institute (Veterinarnyi NII Krasnoi Armii) based in Zagorsk. In the autumn of 1941, the threat of the institute's imminent capture by German forces led to its evacuation to Troitsk (Chelyabinsk oblast'). The institute left behind a group led by Boris Tikhonovich Zuev that had responsibility for the maintenance of the buildings and their contents.[22] The seriousness of the situation in the Zagorsk area is demonstrated by the fact that in October–November 1941 Zhukov was operating his Field Administration for the 1st Assault Army at the site of the veterinary institute.

The prevention of the capture of the military's Veterinary Scientific-Research Institute was of pivotal importance to the Soviet war effort.

The Red Army is reported to have possessed some 526,400 horses at the outbreak of conflict, and this number then rose to as many as two million as the war neared its end. Horses were used in all military operations and could serve both as cavalry and as an essential form of artillery transport. The institute played a key role in maintaining the health of the Red Army's horses and the farm animal population on which it relied for food. Staff members from the facility are reported to have made many visits to front-line positions in order to collect blood and other biological samples from horses suspected of harbouring infectious diseases. Throughout the wartime period, the institute continuously delivered to Soviet military units diagnostics for glanders and also tetanus toxoid for use in veterinary surgical operations—some 3,467,814 horses suffered bullet and shrapnel wounds. In recognition for its efforts, the institute and its staff was awarded the Order of the Red Banner. [23]

The evacuation of Lisii Island

Civil veterinary facilities were also evacuated in the face of the rapid German advance. In 1941, the VIEV, which was located at Kuz'minki, some 16 kilometres south-east of Moscow, was evacuated to Omsk in Siberia. Here, it was based at the Omsk Scientific-Research Veterinary Institute. The institute returned to Moscow from Siberia in 1943.[24]

During the Second World War, the Luftwaffe is reported to have conducted aerial reconnaissance of Lisii Island. The aerial photography of the VIEV branch laboratory revealed the facility to be 'neither extensive nor impressive'.[25] However, this case again serves to highlight that German intelligence had rather good knowledge of the Soviet BW programme. In 1941, as was the case with the nearby Red Army's BW facilities on Gorodomyla Island, the veterinary laboratories on Lisii Island were evacuated. It appears that they were initially transferred to the site of the Kashintsevo Biofactory, north-east of Moscow, and subsequently relocated to Omsk alongside their parent facility, VIEV. In 1944, the Lisii Island base was reactivated and experimentation involving foot-and-mouth disease was resumed.[26]

The evacuation of Soviet large-scale vaccine production plants

On 21 August 1941, the Soviet authorities ordered that specialists and valuable equipment from the Orel Biofactory be evacuated to Omsk.[27]

This city in south-western Siberia was selected as the new base for a number of the Soviet Union's most important veterinary R&D and production facilities. A previous director at the facility reported that personnel from the facility were evacuated to Kuibyshev. The Wehrmacht occupied the city of Orel on 3 October 1941. The factory was then used as the headquarters for German intelligence. Sometime prior to the liberation of Orel on 5 August 1943, the Germans destroyed the bulk of the facility leaving only its original red brick buildings standing. In the early 1990s, the latter was still being referred to locally as the 'Reichstag'. The settlement attached to the biofactory is the site of a mass grave of Soviet soldiers, indicating that this was the site of fierce fighting during the liberation of the Soviet city. The factory's personnel subsequently returned from Kuibyshev, and their facility was rebuilt during the period 1946 to 1957.[28]

Another large-scale facility that was evacuated in the face of advancing German forces was the Kashintsevo Biofactory, north-east of Moscow. In October 1941, the bulk of the plant's equipment, the horses used in vaccine and sera production, and part of the personnel, were transferred to the Siberian city of Omsk. Possibly, the factory was co-located with the VIEV, which had already been accommodated in premises belonging to the Omsk Scientific-Research Veterinary Institute. During the wartime period, the factory manufactured the mallein test, an allergic hypersensitivity test used as a diagnosis for glanders. In 1944, the facility also produced the Soviet Union's first aluminium hydroxide vaccine against sheep pox.[29] Immediately after the war, the plant was restored to its former site near Moscow and quickly resumed production of FMD and other vaccines.[30]

The transfer of microbiological facilities from Kharkov to Chkalov

In October 1941, the Soviet authorities ordered the evacuation of the I.I. Mechnikov Ukrainian Institute of Epidemiology and Microbiology from Kharkov to Stalingrad. The key members of staff, together with equipment and horses used for biologicals production, were relocated to the Russian city on the Volga. Some production of bacterial preparations was begun in Stalingrad but then, in August 1942, a second evacuation was ordered to Chkalov (present-day Orenburg)—a city located some 1,478 kilometres (918 miles) south-east of Moscow, very close to the border with Kazakhstan.[31] At the new site, the institute is reported to have been successful in developing and manufacturing an antiserum against gas gangrene usually caused by *Clostridium perfringens*.[32] In March 1944, efforts began to relocate the Mechnikov Institute back to Kharkov, and by 19 April it had already begun operation in that city.[33]

The Kharkov facility is of interest because it did have possible links to the early Soviet BW programme. During the period 1924 to 1929, its director was none other than Zlatogorov, who was identified by the British SIS as the lead scientist working on the development of a range of offensive biological weapons. Interesting in this respect are German intelligence reports suggesting that a large BW institute was located in Chkalov. According to their sources, since 1939 the facility had despatched mobile units to conduct experiments in remote uninhabited areas near Astrakhan and north-east of the Volga.[34]

The information on an alleged Chkalov BW facility appears to have been provided by a Soviet deserter called Von Apen, who flew himself, along with his wife, across enemy lines and landed on a German airfield. During his interrogation, Von Apen, who was of part German extraction, claimed that he had been a member of an air force group that had received special training in biological warfare at the Perm' Naval Aviation Academy. He noted that, following orders from Stalin, BW experiments had been initiated in the BW facility in Orenburg. These were followed-up with large-scale trials in the borderland between the Soviet Union and Mongolia. Three different agents, plague, anthrax and cholera, were reportedly employed under the general codename *Golden Triangle*. Chkalov was identified by Von Apen as a primary centre for BW research with numerous proving grounds also having been established 'having always in their close proximity a camp for political prisoners to furnish the human experimental subjects'.

Von Apen claimed that in 1941 a Professor Klimoshinskii had conducted experiments on human subjects in Mongolia that involved the use of plague, anthrax and glanders. The subjects were allegedly political prisoners who were restrained by chains and exposed to plague-infested fleas carried by rats held beneath a wire screen. The experiments are reported to have met with 'success', with the transmission of plague to the prisoners. Squirrels and other rodents also proved to be effective intermediary hosts. In the summer of 1941, a plague-infected prisoner is reported to have made good their escape and to have initiated a localised outbreak of the disease. Airforce units were allegedly brought in to eliminate anyone suspected of being infected, and some 3,000 to 5,000 Mongolians died as a result. The corpses were burnt using large quantities of petrol.[35]

Von Apen described to his German interrogators a range of methods that had been developed for the dissemination of BW agents. There included an aircraft-mounted bacteriological sprayer, BR-1, which was used to disperse a bacterial emulsion containing a strain of pneumonic plague. Another method was reported to involve the use of plague-infested fleas carried by rats and mice, which were dropped into enemy territory using specially adapted parachute cages. Von Apen also claimed that he witnessed the use of glass bombs containing bacterial broth. Meanwhile, anthrax targeted against cattle and horses could be dispersed as a fine powder using a BR-2 sprayer. Among the other methods of anthrax dispersal was the use of bacterial spore tablets manufactured at the Orenburg BW institute, which could be deposited in water and the resulting solution sprinkled over fodder. It is alleged that Professor Klimoshinskii contemplated the creation in the north Urals of large-scale facilities for the production of anthrax. Cholera, typhoid fever or dysentery were considered to be the disease agents best suited for use by partisans and saboteurs. The agents could be dispersed via TSW-1 water-contaminating tubes or ice cylinders. Glanders was considered for use by partisans in regions under occupation by enemy forces.[36]

The identification of a powerful bacteriological research institute in Chkalov does appear to lend some credence to the information provided by Von Apen to German intelligence. However, there is absolutely no trace of any Professor Klimoshinskii, or variant spellings of this name, in either Soviet or Western source materials. Clearly, it may well have been the case that Von Apen was exaggerating his own knowledge of Soviet military biological programmes in order to curry favour with his German captors. Prior to any corroboration from other sources, extreme caution should therefore be adopted with regard to the veracity of his entire testimony.

Chkalov and the alleged Soviet programme focused on trichothecene toxins

No discussion of Chkalov during the Second World War would be complete without noting also that the city is linked, coincidentally, to classified studies of powerful trichothecene toxins in the USSR. At some point early in the war, Colonel Marcus Klingberg, a leading Soviet military epidemiologist, was involved in an investigation into a mysterious outbreak of poisoning in the city. Thousands of peasants had died of unknown causes. Klingberg and his colleagues were able to determine that a fungus (*Fusaria*) had infected grain stores and produced a powerful trichothecene toxin.[37]

A declassified 1983 CIA report provides additional information on the Chkalov outbreak. The report notes that a prominent Soviet scientist who had left the USSR in 1958 had served as one of Klingberg's co-investigators in Orenburg. He subsequently:

> traced the origin of the epidemic to natural contamination of grain sources by toxin-producing *Fusaria*. Having identified optimal conditions for toxin production by the fungi, he was ordered to supply large amounts of toxic culture extracts to other Soviet scientists for classified research projects. Subsequent Soviet toxicity studies in humans involved addition of various doses of the toxic material to ground meat which was then fed to political prisoners, and the course of development of toxic effects was monitored. Inhalation experiments were also conducted using monkeys. Techniques for enhancement of toxic effects by combining toxins of different types were also investigated. Extensive debriefings of this source have led us to conclude that his technical bona fides are impeccable and that the striking claims he continues to recall and support are highly credible.[38]

The CIA document also draws attention to German intelligence reports during the war, which detail that among the new war gases under development was a powdery, yellow-brown agent called *lebeda*. It further notes that, beginning in 1941 and continuing until the capture of Hirsch (a leading German intelligence expert on BW), this new agent was mentioned repeatedly by Soviet prisoners of war who had technical training or connections to Soviet chemical weapons schools. The report states that 'Hirsch was not able to identify the agent on the basis of its described properties, but noted an array of symptoms that bear striking similarity to those observed in Yellow Rain victims. Interestingly, the agent was also described as being disseminated in munitions or as an aircraft spray.'[39] There is no way of verifying any of this information, but it does appear plausible that the Soviet military would have become interested in the powerful toxin isolated in Chkalov.

Evacuation of the Leningrad BW labs

As indicated above, the existence of substantive BW facilities in Leningrad and on the Solovetsky Islands remains open to question. According to Alibek, in 1941 the Soviet high command ordered the evacuation of BW laboratories from both Leningrad and the Solovetsky Islands to Gorky on the Volga River. With a highly dramatic flourish, he describes how:

> The lab equipment, fermenters, and glass vials containing strains of diseases were loaded on a train and sent south to the city of Gorky [present-day Nizhnyi Novgorod]. On the day they arrived, Germans subjected Gorky to its first—and only—aerial bombardment of the war. Panicked commanders ordered the train to keep moving.[40]

In fact, the Luftwaffe did not launch a major raid on the tank factory at Gorky until June 1943. A total of 168 Heinkel He-111s took off on the night of 3 June, of which 149 aircraft attacked and dropped 234 tonnes of bombs.[41] The factory was housed in wooden buildings, and as a result of the German attack its operation was brought to a grinding halt.[42] Geographically, Alibek's account of an evacuation to Gorky does appear plausible. However, if he is correct about the air raid, then the second evacuation would have occurred after the 3 June 1943 attack and not immediately upon arrival in the city in 1941, as is suggested. It is stated that the final destination of the evacuated BW laboratories was Kirov, which suggests that the Moscow and Leningrad strands—if indeed the latter did in fact exist—of the early Soviet BW programme may at this point have been united.

Not a trace of Alibek's account can be found in Russian or Soviet sources. According to him, the BW facilities in Leningrad were subordinate to the VMA. During the Siege of Leningrad, more than 1,000 bombs and artillery shells landed on the territory of the VMA. In the early part of the war, two thirds of the professors and teaching staff were directed from VMA to the frontlines. According to official Russian accounts, during the period comprising November 1941 through to January 1942, VMA itself was evacuated from Leningrad to Samarkand in Uzbekistan. Here, it appears to have operated out of facilities belonging to the Samarkand Medical Institute. The academy returned to Leningrad in 1944. To add to the organisational and geographic confusion, because of wartime demand for physicians, from 1939 through to 1942 a second military-medical academy was operational in the city of Kuibyshev. The second academy appears to have disbanded and merged in 1942 with the main VMA in Samarkand.[43]

Escape to Kirov: the creation of the Scientific-Research Institute of Epidemiology and Hygiene

In September 1942, the Sanitary-Technical Institute completed its transfer to Kirov, located just west of the Ural mountains, on the Vyatka River. Here, it was relocated in the premises formerly belonging to the Oblast' Infectious Diseases Hospital (the former Vyatka District Hospital) on Oktyabr'skii prospekt.[44] Sometime around its arrival in Kirov, the facility was renamed as the Red Army's Scientific-Research Institute of Epidemiology and Hygiene (Nauchno-issledovatel'skii institut epidemiologii i gigeny or NIIEG).

It appears that, during the meeting with Colonel-General Smirnov, Stalin may have had the final say with regard to the new site selected for the relocation of the Sanitary-Technical Institute. It appears to be no coincidence that the Infectious Disease Hospital was chosen. For it was here, on 8 February 1909, that Stalin, then known as Ioseb Jughashvili, was admitted after falling sick with relapsing fever—a disease caused by infection with certain bacteria in the genus *Borrelia* and transmitted through the bites of lice or soft-bodied ticks. Stalin had been travelling at the time to his place of exile in Solvychegodsk, Vologda Gubernia. He was not released from the hospital until 20 February.[45] One of the earliest writers on the Soviet BW programme, Mark Popovsky, confirms Stalin's very personal selection of the site in Kirov for the relocation: 'When the war broke out, Stalin had it [i.e. the secret BW facility] transferred farther inland to Kirov [Vyatka] and even designated the building it was to occupy—namely the hospital in which he himself, as Soso Dzhugashvili, had once been a patient before the Revolution.'[46]

Some research on glanders was conducted by the new institute. During the period 1941 to 1945, it was engaged in the development of a serological test for glanders. It is not known whether NIIEG collaborated with the Agricultural Institute located nearby on Oktyabr'skii prospect, 53. There was cooperation during the wartime period with public health and veterinary facilities located at other locations in the USSR. From 1941 to 1946, for example, the Irkutsk and Rostov-on-Don anti-plague institutes collaborated with NIIEG in the study of tularaemia, particularly with regard to prophylaxis with live tularaemia vaccine. Assistance was also provided by Mikrob with regard to the provision of tularaemia strains and anti-plague serum. As early as 1941–2, studies were also commenced of the STI anthrax vaccine in farm animals at the Saratov Veterinary Station.[47] After 1948, presumably in an attempt to conceal knowledge of its R&D programmes, openly published scientific articles ceased to emerge from NIIEG.[48]

Evacuation to the East: The disruption of R&D and production programmes

Although successful in terms of evading capture by advancing German forces, the evacuation of the Soviet Union's military biological facilities to the East is likely to have caused severe disruption to ongoing R&D and production programmes. In her penetrating study of the Soviet pharmaceutical industry during the war, Mary Schaeffer Conroy notes that 'Evacuation of pharmaceutical factories, though perhaps necessary and heroic, was extremely disorganized and disruptive.'[49] Evacuated materials did not always reach their destination, and sometimes the premises designated for relocated facilities were occupied. In the case of evacuated manufacturing equipment from the Semashko Pharmaceutical Factory, for example, only after being on the road for a month and a half was it allocated the space allotted for it in the city of Anzhero-Sudzhensk. In addition, the evacuated pharmaceutical plants experienced losses of raw materials and finished products along with incurring high costs associated with the movement of equipment, workers and their families. In the fourth quarter of 1941, there was 'scarcely any production' in the pharmaceutical industry, and the government halted the evacuation process. By 1944, superfluous machinery was being shipped back from poorly performing satellite facilities in the East to the factories in Moscow.[50] NIIEG and other military biological facilities are likely to have been similarly affected as a result of their evacuation eastwards.

Plague, rats and tularaemia: the alleged use of offensive biological weapons at the Battle of Stalingrad

The backdrop

In his study of the Soviet Union in the Second World War, Christopher Bellamy contends that if either side was going to break the 1925 Geneva Protocol prohibiting the use of gas and bacteriological warfare, to which they had both agreed to abide, then 1942 was the most likely year. Given that it was at this time that both the fate of the Soviet Union and that of the Third Reich hung precariously in the balance during the build-up to, and outcome of, the Battle of Stalingrad, his conclusion is perhaps unsurprising. Hitler's aims at Stalingrad were to destroy the city's industrial capacity and to block the Volga River, which was a key route linking central Russia to the Caucasus and the Caspian Sea. Both sides were faced with an existential crisis during the different phases of this decisive battle, and the temptation to use any and all means at their disposal to influence the outcome must have been enormous.

One intriguing event in the prelude to the Battle of Stalingrad concerns a British intelligence report of 1 April 1942 to the Chemical Defence Research Establishment (Porton Down) concerning the prevailing winds on the Eastern front. The report appears to be a response to intelligence that had been received at this time concerning the use of poison gas by one or other of the combatants. The prevailing winds at this time could only have favoured the German use of poison gas in the Leningrad sector or favoured the Soviet forces in the southern half of the front.[51] Clearly, both sides in the conflict at this time were nervously monitoring the other for any indications that there had been chemical or biological attacks upon their forces.

On the edge of the abyss in the summer of 1942: Soviet and German fears of plague outbreak

In the summer of 1942, the chance capture of a Soviet chauffer in Stavropol was to provoke frenzied speculation among both the German and Russian forces that an outbreak of plague was imminent. The German soldiers who captured the automobile took a close interest in its Moscow plates and interrogated the driver. The individual concerned was revealed to be none other than the chauffer of Professor Isaak Iosifovich

Rogozin, a leading plague specialist. Rogozin had a military background with expertise in biological defence, having previously been appointed in 1935 as a head of department within the Red Army's Scientific Research Experimental Sanitary Institute (Nauchno issledovatel'skii ispytatel'nyi sanitarnyi institut Krasnoi Armii, or NIISI for short). Later, in 1936, he was transferred to the Red Army's Main Military-Sanitary Directorate (GVSU). He served within GVSU during the Second World War.[52]

Rogozin, at this time the head of the People's Commissariat of Health Anti-Epidemic Directorate, had arrived in Astrakhan to coordinate efforts to combat an outbreak of tularaemia in Red Army troops. Up until the outbreak of the war, his driver had been employed at the Stavropol Anti-Plague Institute. The latter explained to his German interrogators that he had requested to Rogozin that he be granted leave to return to Stavropol to evacuate his family. However, he was unable to escape Stavropol because the Germans had overrun the city. The driver informed his interrogators that he had taken Rogozin to Astrakhan.

Soviet sources indicate that the information concerning the arrest of Rogozin's chauffer rapidly found its way to a group of high-ranking German physicians. They are reported to have been aghast. Rogozin was known to the Germans for his work in the field of plague prophylaxis, and they therefore concluded that it was conceivable that a plague epidemic was raging in southern Russia. Immediately, all of the German troops being dispatched to the southern Russian front were vaccinated for plague. This in itself is reported to have provoked some degree of panic. Meanwhile, Soviet intelligence is reported to have obtained documents relating to the German immunisation. Senior Soviet medical personnel, fearing that the Germans might be preparing an attack using biological weapons, then ordered the vaccination of Red Army units.[53]

German sources, while confirming the plague vaccination, give a somewhat different account of events. They report that, in 1942, German intelligence obtained information from prisoners that the Red Army units operating at the Stalingrad front had all recently been immunised against plague. Bellamy points out that this would have been a major achievement in an army in which troops could not even be persuaded to wear identification capsules because they were considered bad luck. He does concede that with the NKVD in control in the city, the Soviet military medical services might just have pulled it off.[54]

Whatever the actual case, the Germans consulted with Professor Kliewe, head of a department in Berlin working on BW. Kliewe had some considerable knowledge of the Soviet BW programme, having received some sixteen reports detailing the activities of enemy scientists. By this point in time, he had become the focal point for BW information and collected reports on known or suspected BW use, especially—after the launch of Barbarossa—on the Eastern front. Although Kliewe was convinced that the Soviet Union had an extensive biological warfare programme, judging that 'no other country has built similar instruments, not even France', he confessed after the war that Germany had no documentary proof of Soviet BW programmes or operations.[55] Much of the intelligence Kliewe had received focused on plague, with one account detailing how the:

> Soviets had prepared infected rats and these were to be placed in special cages attached to parachutes which opened after landing. They had even gone so far as studying the rat population in different parts of Europe so that the right variety of rat would be dropped and so have a chance to survive.

Upon learning of the Red Army's immunisation programme in an area not normally a focus of plague infection, Kliewe gave his opinion that 'the Russians might be contemplating the dissemination of plague'. He therefore recommended that sufficient plague vaccine be immediately dispatched to the front line for the immunisation of one million men. Some 3,000 litres of vaccine were procured from stocks held at the I.G. Farben Behringwerke laboratories in Marburg. Although the vaccine was delivered to the front, Kliewe claims that it was never used. According to Kliewe, his own fears of the Soviet use of plague were not abated, and even as late as 1944 he reports that he learnt in Budapest that the Soviets were contemplating its use. However, Kliewe admits that a Russian doctor he interviewed in Warsaw informed him that he had never heard the subject discussed in the Red Army.[56]

Tularaemia outbreak at Stalingrad in the late summer of 1942

In his account of the Soviet BW programme, Alibek raises the intriguing possibility that the Red Army engaged in deliberate aerosol dissemination of tularaemia (*F. tularensis*) against German panzer troops in the late summer of 1942. According to Alibek: 'Only exposure to a sudden and concentrated quantity of tularaemia could explain the onslaught of infections in the German troops alone. Seventy per cent of those infected came down with a pneumonic form of the disease, which could only have been caused by purposeful dissemination.'[57] He alleges that, as a result, the Nazi campaign in southern Russia ground to a temporary halt. Within a week of the initial outbreak, Alibek reports that tens of thousands of Soviet soldiers and civilians living in the Volga region were also infected with tularaemia. In the face of the epidemic, the Soviet high command is reported to have despatched no fewer than ten mobile military hospitals into the affected region. He postulates that the outbreak behind the Soviet lines must have been caused by a sudden change in the wind direction or by contaminated rodents spreading the infection. Alibek offers data from an unnamed epidemiological study to support his case. This purportedly shows that, in 1941, 10,000 cases of the disease were reported in the USSR. The number of cases then increases tenfold in 1942 to 100,000 before the incidence of disease returns the following year to 1941 levels.[58]

Alibek's key piece of evidence for his claims concerns information provided to him by a veteran of the Soviet BW programme. The individual, who is reported to have been a lieutenant colonel, was based at the USSR Ministry of Defence's BW facility in Kirov. According to this source, a tularaemia weapon had been developed in Kirov in 1941, a year before the Battle of Stalingrad. Moreover, the veteran left Alibek in no doubt that the weapon had been used by the Red Army against the German forces outside Stalingrad.[59]

Alibek's claims were subsequently revisited by a website, Pravda.ru, which is no longer connected to its original *Pravda* parent newspaper, published by the Russian Communist Party. The website's report suggests that the USSR employed *Francisella tularensis*:

> against Friedrich von Paulus's army. The Soviet government did not risk to [sic] infect fascists with plague or ulcer—they chose tularemia. Rats spread the disease in German troops very quickly. The effect was astonishing: Paulus had to take a break in his offensive on Stalingrad. According to archive documents, about 50 per cent of German prisoners, who were taken captive after the battle of Stalingrad, were suffering from classic symptoms of tularemia. Unfortunately, every action leads to a counteraction. The use of infected rats against the Nazi army had an

> inverse effect too: the disease came over the front line, and infected a lot of Soviet soldiers … Soviet scientists continued their research with the tularemia microbe after the end of WWII. Military biologists brought the bacteria to perfection at the end of the 1970s, having increased its destructive capacity.[60]

No sources are provided in the report and one is left to speculate whether this is just an example of lazy journalism, the reporter simply rewriting Alibek's account for the website's own readership but attempting no critical penetrative analysis.

Given that the Soviet hold on Stalingrad was hanging by a thread and the strategically pivotal city was likely to fall at any moment to the German forces, one can postulate that there must have been considerable temptation to employ biological and/or chemical weapons, if they were available. As Bellamy states,

> the Russians … were desperate. They had a huge arsenal of chemical weapons and had also paid great attention to developing biological weapons during the 1920s and 1930s. If there was ever a time to break international treaties (and if they lost, would it matter? Or if they won, could anybody argue?) it might be now.[61]

A high degree of caution, however, needs to be exercised before rushing to the conclusion that biological weapons were definitely used at Stalingrad. German specialists, for example, note that while tularaemia outbreaks were frequent on the Eastern front, neither their number nor their character gave any cause for alarm. The affected soldiers ascribed their infection primarily to contact with sick or dead mice or to consumption of food or unboiled well water contaminated by the animals. Meanwhile, the German's estimated that, in the winter of 1941, the Red Army was suffering so much from this disease that in some of its units more than 50 per cent of combat troops were unfit for action. As a consequence, the Red Army is reported to have made a sustained effort to manage outbreaks via large-scale anti-rodent, particularly anti-mice, campaigns, which included a particular emphasis on the sanitation of wells.[62]

Commenting on the tularaemia situation in the western parts of the USSR during the war, a Soviet specialist noted that:

> The epidemiological importance of tularaemia infection by inhalation became particularly great in the oblasts and raions temporarily occupied

> by the fascist invaders. In those oblasts extraordinarily favourable conditions were created during that time for mass multiplication of the mouse species of rodents. Thus of great importance was the suspension of all agricultural and anti-rat operations, the presence of large areas of uncultivated arable land, the delayed harvesting, the massive abandonment of unthreshed grain stacks on the fields, the mass destruction of grain storehouses and elevators, the abundant overgrowing of the farm plots and whole settlements (destroyed by the fascists).[63]

A number of prominent scholars have disputed Alibek's account of the deliberate aerosol dissemination of tularaemia by the Red Army at Stalingrad in the late summer of 1942. A forensic demolition of Alibek's account is presented in a paper published in December 2005 by Geissler. He notes that tularaemia is endemic in the region and that in any case a large outbreak occurred during the winter of 1941–2. Geissler argues that German troops only developed tularaemia after infections among the local civilian population. Moreover, he cites the leading Soviet epidemiologist, Viktor Zhdanov, as stating that there were 100,000 cases per annum throughout the 1940s and not only in 1942. Geissler also points to infected rodents as being the key to the large-scale outbreaks. He refers to a paper by Rogozin, who during the war had been head of the Anti-Epidemic Department of the People's Commissariat of Health. Rogozin concluded that a decisive source of infection with *F. tularensis* was the inhalation of dust from contaminated straw used in mattresses. Most of the cases of inhalationary tularaemia may have resulted from the inhalation of contaminated straw, hay or soil. Again, Geissler points to the large rise in the numbers of rodents as a result of crops being left in the fields because of the fighting, a key cause of the outbreaks of tularaemia in the Volga region. Crucially, Geissler notes that there are no contemporary accounts by the German army or intelligence services of the use of *F. tularensis* as a biological weapon at Stalingrad. While regarded as a war disease, from the German perspective it was much less important than other diseases.[64]

Hitler and Himmler's alleged discussion of chemical and biological warfare, November 1942

Such was the life and death struggle facing both combatants at Stalingrad that it is not surprising to learn of intelligence reports in early November

1942 indicating that the German leadership had been discussing the use of biological and chemical warfare. Bellamy accessed FSB archives that detail a meeting on 26 December 1942 of the Soviet State Defence Committee (GKO) at which Beria presented information forwarded to him by the NKVD resident in London. The latter had himself received the information from one of his agents as long ago as early November—the reason for the substantial delay in the information reaching Moscow is not known.[65]

Beria reported to the GKO that the British Foreign Office had received reliable intelligence from Polish sources regarding discussions between Hitler and Heinrich Himmler. The two German leaders are reported to have concluded that 'In the event of a significant worsening of the German situation, the German command would use poison gases and bacteria ... As a result of this meeting, German industry, it is said, must be given authorization to produce large amounts of poison substances and apparatus for chemical and biological warfare.'[66] There were no indications provided as to where the Germans might consider the use of such weapons, although Stalingrad was an obvious candidate. The British Foreign Office was reported to be taking the report very seriously, although it did not consider that the German position had yet deteriorated sufficiently that the use of such desperate measures would be authorised.[67]

Meanwhile, German military intelligence continued to receive reports about alleged Soviet intentions for BW use. In December 1942, Himmler, the SS chief, had reported to Hitler that a captured NKVD document detailed an order giving instructions for the use of chemical and biological agents against German troops. A typhus epidemic in the Karachev region, south-east of Bryansk, where more than 2,000 persons were infected, and a typhoid outbreak in the German military garrison in occupied Kiev, were linked the following year to guerrilla activity. In January 1943, sources within the Swedish embassy in Bucharest provided information on intensive biological warfare preparations in both Moscow and Saratov. It was anticipated that the Soviets would launch BW operations in the middle of that month.[68] It appears that both the Germans and the Soviets believed their opponents were preparing for the use of biological warfare, although the military preparedness in reality of both sides in this regard remains open to doubt.

The alleged use by Soviet-supported partisans of biological agents against the German occupation forces

According to Professor Kliewe, a number of BW sabotage operations had been launched by Soviet-supported partisans against the occupying forces in the Soviet Union. All reports of such incidents were sent to Kliewe, and in some cases he actually visited the scene of the alleged incident and conducted his own investigation.[69] Kliewe in particular points to guerrilla activities in 1943 in the Krachev region, where a typhus epidemic with 2,808 persons infected, was believed to have been deliberately propagated.[70] In another incident at this time, Kliewe was summoned to investigate a typhoid epidemic that had broken out in the German military garrison in occupied Kiev. He concluded that the outbreak had been a deliberate act of sabotage conducted by a Czech deserter who had deliberately contaminated coffee in canteens with typhoid bacteria.[71] Paul Weindling is sceptical of these alleged incidents and notes that, during the war,

> Kliewe conjured up all sorts of dastardly scenarios by saboteurs in order to magnify the threat of a biological offensive against the Germans. He reported on the placing of louse excrement in wardrobes, and in gifts of sweets or cigarettes to soldiers so as to induce typhus … and typhoid bacilli were slipped into drinks or injected into eggs. Lengthy catalogues were compiled of incidents of sabotage resulting in mysterious illnesses and acts of resistance by barbers, kitchen maids and medical personnel.[72]

The best-documented case of the use of biological agents by Soviet-supported partisans concerns the alleged use in 1942 of epidemic typhus (so-called spotted typhus), an acute infectious disease caused by *Rickettsia prowazekii* and transmitted by the human body louse (*Pediculus humanus humanus*). Under the leadership of a Soviet doctor named Fedor Mikhailovich Mikhailov, who was probably an operative of the Intelligence Directorate of the South Eastern Front Staff, a partisan group targeted POW camp No. 357 close to Slavuta, located in Khmelnytskyi oblast', Ukraine. Typhus-carrying lice are reported to have been delivered from Slavuta to the camp, where they were used to infect the guards. In his autobiography, Abram Likhtenshtein, the former translator for the camp commandant, notes that 'Out of 51 guards, 28 came down with spotted typhus; 8 of them died, 2 of them were non-commissioned officers.' Another source records that sixteen German pilots were infected with typhus. A report of the Central Committee of the Communist Party (Bolshevik) of Ukraine—CC CP(B)U—refers to the use of spotted typhus and the destruction of 100 enemies. In May 1965, Mikhailov was posthumously awarded the title of Hero of the Soviet Union.[73]

Alexander Gogun, who compiled this account of the use of epidemic typhus by Soviet-supported partisans, argues that:

> This is the only known case of the operational use of a weapon of mass destruction (WMD) in World War II in the European theatre of war. Its modest scale should not be underestimated, for typhus is a bacteriological weapon and therefore an example of a WMD, especially if one considers its capacity and even tendency towards self-propagation … Furthermore, this is one of the very few documented cases of operational use of bacteriological warfare in history. It is no accident that even during the most savage conflicts, combatants rarely fought against any enemy in this manner, for the simple reason that they were fearful of using such a 'double-edged-sword'. But Dr Fedor Mikhailov, a Soviet physician who had been trained by professionals, used it without compunction during a total war of extermination.[74]

However, there is no evidence presented that this attack formed part of a wider, centrally coordinated, campaign of biological sabotage by the Soviet authorities. Rather, it appears to be a result of individuals using their own initiative to take advantage of a specific set of local circumstances.

Allegations of deliberate exposure of Soviet population to typhus and dysentery

Germany may not have subsequently employed biological weapons directly, but there is evidence pointing to the deliberate instigation of disease outbreaks among the Soviet population. One of the main sources of these allegations is Avraham Marek/Marcus Klingberg who in 1952 was one of the founders of the top-secret Israel Institute for Biological Research (IIBR) at Nes Ziona, about 10 miles south of Tel Aviv. Klingberg used his position to pass information about Israel's BW programme to the KGB. The Israeli authorities tried Klingberg in camera in Tel Aviv District Court and secretly sentenced him in June 1983 to eighteen years' imprisonment. Klingberg spent the first ten years of his sentence in solitary confinement.[75]

Klingberg was originally born in Warsaw, Poland, in October 1918 to an observant Jewish family. He completed secondary school in 1935 and then studied medicine in the Medical Faculty of Warsaw University.[76] In 1939, at the urging of his father, who feared the Nazis, he made his escape to the USSR where he completed his medical studies at the University of Minsk (Belarus) in 1941. Both his parents and his brother left behind in Poland were killed a year later in the Nazi extermination camp at Treblinka. On the day of the German attack on the USSR, Klingberg volunteered for the Red Army and was made a captain in the Medical Corps. After being wounded in his right leg on the Belarusian front, he was sent to Perm (then known as Molotov), in the Urals, where he was appointed head of an anti-epidemic unit. The unit included physicians, paramedics (feldshers), nurses and disinfection personnel, and possessed its own small mobile laboratory for serological tests. In June 1943, Klingberg was sent to Moscow for postgraduate training by the leading epidemiologists in the Soviet Union, including Professor Lev Gromashevskii.[77]

By the end of 1943, some areas of eastern Belarus had been recaptured by the Red Army. Klingberg, who eventually rose to the rank of colonel, was appointed as chief epidemiologist of the Belarusian Republic. Here, in the face of masses of refugees and hundreds of thousands of wounded, who were surviving with inadequate nutrition, poor sanitary conditions and lack of heating, Soviet military medical personnel were faced with the ever-present danger of epidemics. Epidemic typhus remained Klingberg's primary concern, but he also had to deal with epidemics of typhoid fever, bacillary dysentery, scarlet fever, rubella and measles. There was also an outbreak of malaria in one district, and scabies was present everywhere.[78]

There appears little reason to doubt Klingberg's account of the retreating German army's use of epidemic typhus as a weapon. He describes how, in 1944, in the Mozyr region of Belarus,

> the Nazi troops put tens of thousands of unaffected Soviet citizens in a detention camp they were evacuating where epidemic typhus was raging. The Germans knew that the Red Army would try to rescue these people, and this was a way of targeting it. We were charged with the task of isolating the sick and quarantining those who had had contact with affected individuals. In this way, we succeeded in preventing contamination of the Red Army.[79]

Klingberg's account is supported by a Czech source that also refers to German BW diversion actions that were intended to disrupt the advance of the Red Army. This same source provides details of a specific incident in May 1945 when a reservoir with drinking water for 10,000 persons in north-western Bohemia was repeatedly polluted by the Germans with faecal material. This is reported to have resulted in a widespread outbreak of dysentery. The writer of this account was the chief epidemiologist and investigator responsible for determining the origins of this incident.[80]

Confronting the Japanese army's secret of secrets: the use of biological weapons in the Far East

Japanese allegations of the use of biological warfare by the USSR in Manchuria, 1935

The Japanese invasion of Manchuria in 1931 was a cause of alarm in the Soviet Union and provoked the launch of numerous reconnaissance missions along the ill-defined Manchukuo–Mongolia–USSR border. Both sides accused the other of hundreds of separate border violations. The Japanese at this time appear to have feared the Soviet Union's potential with regard to biological warfare. Ishii Shirō, the lead figure in Japan's own notorious BW programme, stated that he anticipated that the Soviet Union would use BW because:

> They had used it previously and I expected them to use it again … I heard over the radio that Russia had completed its preparations for BW and it frightened me, but I did not know whether it was an actual fact or was just printed in *Red Star* or some other paper as a 'scare'. I do not know how far they have advanced in BW and have wondered what they would use if they attacked with BW.[81]

Ishii believed the Soviet Union might use tularaemia, typhus fever, cholera, anthrax and plague. He noted that 'I heard reports from people returned from Russia that the Russians had been using these organisms in their preparation for BW.'[82]

It was against this background of acute mistrust that, in October 1934, Velikanov, the lead scientist in the Soviet BW programme, travelled to Japan. A substantive part of his brief presumably focused on the gathering of intelligence with regard to Japanese capabilities in biological warfare. Just a year later, the Soviet Union is alleged to have launched BW attacks in Manchuria. Interviewed at the end of the war, Colonel Tomosada Masuda requested permission to explain the stimulus for the initiation of Japanese BW activities. According to his account, in 1935, the Kwantung Army was informed that many Russian spies, carrying bacteria in ampules or in glass bottles, had crossed into Kwantung Territory. Five spies were apprehended by the Kempei and on these spies were found several glass bottles and ampules. Such incidents were not the first nor were they the last, but Col. Masuda stated that he can personally vouch for this episode involving five individuals. The examination of the various containers revealed the presence of dysentery organisms (Shiga and Flexner) and bacteria—spore mixtures of *B. anthracis* and *V. cholerae*. He stated that he personally saw the anthrax organisms.[83]

Interrogation of a second Soviet captive held by the Japanese yielded additional information. The USSR was believed to have employed Chinese guerrillas to poison wells with cholera in the Shanghai area, resulting in the deaths of 6,000 Japanese soldiers. In addition, in 1934 or 1935, saboteurs were thought to have disseminated anthrax, which killed 2,000 horses that were being used in the building of the Pejangchiang to Heihō railway. One should be extremely cautious about accepting the veracity of any of these Japanese claims concerning Soviet biological warfare since, at this time, Lieutenant General Ishii Shirō and his colleagues were seeking to legitimise the launch of their own large-scale offensive BW programme.[84]

The creation of the Pingfan BW complex in Manchuria

Soviet fears concerning a possible Japanese offensive BW programme were realised in 1936 with the formation by Emperor Hirohito of Unit 731, which was given the innocuous-sounding name of the Epidemic Prevention and Water Supply Unit of the Kwantung Army. On 1 August 1936, Ishii Shirō was given formal command of the unit, which was tasked with developing a biological weapon to win the war for Japan. On 30 June 1938, the Kwantung Army began preparations to move the Ishii Unit to Pingfan, located some 24 kilometres south of Harbin. It then took two years to construct around 150 buildings at the site, which included a large administration complex, accommodation units for thousands of personnel, a power plant with cooling towers, an animal house and an insectarium. The new facility was provided with its own rail spur and an airfield. At its very heart was a square-shaped building—the *Ro* block—which was the centre for disease research and production of bacteria. The facility incorporated two units each capable of manufacturing up to 300 kilogrammes of *Yersinia pestis* per month. The Pingfan BW facility had emerged from relative obscurity to become an establishment of national importance.[85]

Despite strenuous attempts to maintain secrecy, it appears to be the case that the Soviet Union very likely knew of the Japanese BW activity in China very soon after Unit 731 was established. Rumours of the secret installation quickly spread among the locals living close to the Pingfan facility. Then, dark Dodge vans appeared, both in the vicinity of Pingfan itself and in the nearby city of Harbin. The Russian-speaking inhabitants of the latter christened these vans v*oroniki* (ravens), and they were used by Ishii's men to kidnap unsuspecting civilians for use in BW experiments. Another more obvious manifestation of activity at the site was the appearance of Chinese road-crews under Japanese control, building a paved road from Harbin to Pingfan. When opened, a large volume of military traffic was witnessed on the route.[86] At some point in the late 1930s, in order to determine the nature of the activities at the site, the Soviet consulate in Harbin undertook the launch of a small transparent hydrogen balloon equipped with a tiny camera. It is reported to have been used to secretly photograph the entire Pingfan complex from high above.[87] It is not clear how much Soviet intelligence knew concerning the extent of Pingfan's experiments and germ warfare activities, but the discovery of the vast BW facility in Manchuria must surely have set alarm bells ringing in the Kremlin and probably resulted in an immediate acceleration in the expansion of the Soviet Union's own military biological programmes.

The Nomonhan incident: The first large-scale BW use by Japan in the Battles of Khalkhin Gol, 1939

The Battles of Khalkhin Gol (Nomonhan) comprised the decisive engagements in the undeclared border conflicts fought between the Soviet Union and the Empire of Japan between May and September 1939. Fighting continued throughout the summer in the remote, desert-like border region. The Japanese 6th Army eventually occupied a disputed area between Nomonhan, where the Soviet Union and its Mongolian allies believed the border to be, and the River Khalka, where the Japanese asserted the border to be. Although certainly not all were engaged, some 75,000 Japanese troops faced 57,000 troops of the 1st Army Group led by Komkor Georgii Zhukov. On 19 August, Soviet and Mongolian troops moved forwards on both flanks of the Japanese position, completing a double envelopment. Zhukov then set to work on destroying the trapped enemy with artillery and air attacks. The Japanese divisional commander and 400 survivors succeeded in escaping and the incident was resolved diplomatically.[88] The Nomonhan Incident was a crucial battle since the Japanese government now focused on seizing the resources of South East Asia rather than attempting any land-grabs in Siberia.

Ishii Shirō, head of Detachment 731, viewed the outbreak of hostilities at Nomonhan as presenting a tremendous opportunity to launch battlefield experiments to test the potential of large-scale BW attacks. His lobbying was initially resisted since Lieutenant General Kenkuchi Ueda, the Kwantung Army commander, feared retaliation in kind once the Soviets had detected that they had been attacked. However, by July 1939, with his troops in a precarious situation, General Ueda gave permission for Ishii to launch a BW attack. On 12 July, Ishii assembled two special suicide teams, comprising twenty-four personnel, who used rubber boats to cross to the Soviet side of the River Khalka, where they deposited from canisters some 22.5 kilogrammes of prepared salmonella and typhoid bacteria. Water samples were then taken and the scene photographed before they fled the area in great haste. A survivor of another BW attack launched at the end of August later recalled that:

> We were sent out in three trucks with extra fuel to take us to the river demarcating the border. During the night, in pitch blackness, the squadron leader gave us the order to spray germs throughout the area … We used typhoid germs. I learned later that our squadron leader contracted typhoid and died from the disease.[89]

No information is available about the impact of these operations, but from Ishii's point of view it provided his men with invaluable battlefield experience.

Ishii's unit also deployed specially adapted artillery shells against its Soviet adversaries. The shell contained bacteria-filled steel heads, each of which was 1.5 centimeters long and 0.5 centimetres in diameter. More than 2,000 shells are reported to have been stockpiled in Hailar. In July and August 1939, the entire arsenal of projectiles was launched against Soviet forces but again with inconclusive results. While there were outbreaks of plague, dysentery and cholera in both Soviet and Japanese troops, it is impossible to determine whether these were due to the primitive sanitary conditions experienced in the hostile environment or were the result of BW attack.[90] Certainly, there is no evidence of any Soviet awareness that they had been subjected to BW attack by the Japanese forces. Be that as it may, Ishii's efforts during the battle were rewarded with the presentation to him in April 1940 of the Third Order of the Golden Kite and the Middle Cord of the Rising Sun. His unit was shortly thereafter also recognised with the issue by General Ogisu of the Kwantung Army of a testimonial of praiseworthy conduct. The 23 May 1940 edition of the Tokyo *Asahi Shimbun* newspaper noted that:

> The awarding of a commendation, in particular to the hygiene unit commanded by the Ishii Unit, was the first such honour ever accorded a hygiene unit in the history of our country … the unit, overcoming all hardships contributed to the securing of an advantageous tactical operation position of a large brigade force.[91]

There is also evidence that the Japanese launched additional BW attacks against the Soviet Union. In the summer of 1942, Unit 100, for example, is reported to have contaminated the Derbul River with glanders bacteria. The river flows into the Argun along the Soviet–Manchurian border where Soviet army units were stationed. Yujiro Wakamatsu, director of Unit 100, ordered that, in the event of a Soviet invasion, his men were to infect large groups of sheep, cows and horses with anthrax, cattle plague and other epizootic diseases. In 1994, Ogura Yoshikuma, a former intelligence agent who focused on germ warfare in sabotage missions, revealed that:

> I used to carry back bacteria from Unit 731, inject them into pigs and other domestic animals, and release the animals into Soviet territory … There were also what we called 'Q' operations. We would fill balloons with nitrogen and suspend containers of bacteria below them. They would be released to drift over Soviet territory to disperse bacteria. We never found out what effects this tactic had.

There is no indication about when precisely these latter attacks were launched or what pathogens were involved. The Soviet authorities appear to have been unaware of the attempted attacks by the specially trained Japanese teams.[92]

Alleged Soviet BW activities in Manchuria, 1941–4

Japanese intelligence continued to receive reports of Soviet preparedness for biological warfare in the event of an outbreak of hostilities. In October 1941, the intelligence section of the Kwantung Army issued a document entitled 'Defence and Security Intelligence Report No. 8: Chinese Employment of Chemical and Bacteriological Warfare against the Japanese'. The document noted that, according to recent reports, the Soviet consul in Harbin, acting on orders from Moscow, had delivered bacteria to agents who had been secretly infiltrated into the main cities in Manchuria. They would launch a BW attack immediately upon the outbreak of hostilities between Japan and the Soviet Union. The targets for attack were purported to include military commanders and technicians, as well as factories, government schools, trains, ships, labourers and military horses.[93] That no such biological attacks were in fact initiated when the Soviet Union invaded Manchuria in August 1945 suggests that the information supplied to Japanese intelligence was unreliable.

In 1950, additional allegations were made with regard to Soviet BW attacks in Manchuria. Major T. Iinuma, a witness at the Khabarovsk war crimes trial of Japanese BW personnel, informed the *New York Times* that 'former Col. Torajiro Kitamura had told him in jail at Khabarovsk that the Russians threw cans containing anthrax germs into Japanese-occupied Manchuria. Iinuma said the incident occurred at a place called Shenho in 1944, before Russia and Japan were at war.'[94] Again, there is little evidence available to substantiate this claim, based on hearsay, which was published at the height of the Cold War.

The invasion of Manchuria and capture of Japanese offensive BW installations by the Red Army

On 9 August 1945, shortly after the devastation of Hiroshima, the Soviet Union launched its invasion of Japanese-controlled Manchuria. The Red

Army had assembled 1,669,500 troops for the operation, and within a week Japan announced its decision to surrender and the instrument of capitulation was signed on 17 August in the Soviet city of Khabarovsk. However, not all Japanese units got the message, and fighting in fact continued through to 1 September.[95]

On the very day of the Soviet invasion, or possibly the day after, General Otozō Yamada, commander in chief of the Kwantung Army, ordered the destruction of the two most powerful offensive BW facilities in China, Unit 731 (Pingfan, near Harbin) and Unit 100 (Changchun). A sapper unit based in or around Harbin was immediately brought in by Unit 731 to blow-up Pingfan's main administration building. In all, it took three full days to destroy the main buildings, although some structures remained resistant to dynamite. Some human experimental subjects held in captivity at the facility were killed by a specialist chemical warfare unit, and others were killed by adding potassium cyanide to their food. Labourers at the site were machine-gunned. Eight Ford trucks were loaded with 50 kilogramme bombs and used to ram buildings. Biological munitions such as the Uji ceramic bombs were smashed or incinerated. During the ensuing chaos, whether by chance or design, thousands of infected rats were released into the neighbourhood of Pingfan. This resulted in a local plague epidemic that raged through to the summer of 1946.[96]

Branch chiefs at Pingfan issued their entire personnel with potassium cyanide capsules for use to commit suicide in the event of capture by the Soviets. Some staff members took to the hills to commit collective suicide. The bulk of the 2,000 or so personnel were loaded into fifteen freight trains that made their way first to Harbin, then onwards to Changchun (then known as Hsinking), before finally arriving in August at the South Korean port of Busan (known in Japanese as Fusan) before onward transit to Japan.[97]

The invading Soviet troops were also poised to seize another major veterinary offensive BW facility located in the north-eastern city of Changchun (Hsinking). In 1936, the Kwantung Army Antiepizootic Protection of Horses Unit was established by imperial decree at Mokotan, around 6 kilometres south of Changchun. Known as the 'Wakamatsu Unit', and later, for purposes of military secrecy, to be designated as Unit 100, the facility was ostensibly created to focus on disease prevention in animals with utility for the Kwantung Army. However, in reality its real role was to expand research on anti-crop and anti-animal biological weapons. Unit 100's campsite is reported to have occupied an area of approximately 20 square kilometres. It embraced a large two-storey headquarters building incorporating underground tunnels to other laboratory sites and several dozen other buildings. Among them were three large red-brick stables each holding fifty horses, and other stables housing oxen and sheep. The facility is reported to have employed between 600 and 800 personnel, and between 1936 and 1945 leading bacteriologists, zoologists and veterinarians from Japan served tours of duty within the complex. The unit also embraced branches in Dalny, Darian, Hailar, Kershan, Lagu and Rako Station (with additional satellite branches later being created at Dongan, Dongning, Jining and Siping).[98] Its commander, Major Wakamatsu Yujiro, reported both to the chief of the Veterinary Service and the director of intelligence operations of the Kwantung Army.[99]

The primary research focus of Unit 100 was on bacteria (including anthrax and glanders), protozoa (*piroplasmosis*) and livestock viruses (the latter including sheep pox, equine infectious anaemia and rinderpest).[100] Human experiments were focused on plague, anthrax and glanders. Unit 100 also succeeded in establishing facilities for the large-scale production of a range of bacterial pathogens including anthrax, plague, glanders and nose ulcer. During the years 1941 and 1942, the facility was producing 1,000 kilogrammes of anthrax bacteria per annum and up to 100 kilogrammes of glanders bacteria.[101]

Before the arrival of the Soviet occupation troops in August 1945, every effort was made by the Kwantung Army to destroy the Changchun BW facilities and its satellite outstations. High-explosives were employed to blow-up buildings, and where expensive equipment could not be transported, it was smashed. Any remaining equipment, together with as much data and research material as could be managed, were shipped back to Japan. Chinese civilian workers employed at the Mokotan camp, together with prisoners, were eliminated, again via the use of potassium cyanide injections.[102]

The Red Army captured the cities of Harbin and Changchun on 20 August 1945 and is likely to have immediately prioritised seizing control of Japan's BW facilities at Pingfan and Mokotan. It is likely that selected personnel from Kirov will have been tasked with gaining first and unrestricted access to any BW documentation and/or equipment at Units 100 and 731 that had survived the systematic attempt to destroy all traces of the facilities. It is possible that some know-how and technologies of value to the Soviet BW effort would have been procured as a result. In an interview in 1999, Lieutenant-General Valentin Ivanovich Evstigneev, a senior figure with responsibility for the management of the Soviet BW programme, acknowledged that during the military operations in Manchuria in 1945, samples of Japanese biological weapons were captured. However, he claimed that these were loaded on to a ship bound for the USSR that subsequently disappeared without trace and thus 'we received nothing from the Japanese in terms of biological weapons'.[103]

The capture of Japanese BW personnel and their alleged participation in the Soviet BW programme

Given the coordinated efforts to destroy all traces of the Japanese BW facilities in Manchuria, the focus now switched to apprehending any personnel associated with Units 100 and 731 and associated detachments. The Red Army had captured between 560,000 and 760,000 Japanese prisoners of war. The NKVD is immediately reported to have begun a process of filtration of the captives in search of those individuals engaged in activities related to the BW programme. This process even included low-ranking members of the Unit 731 gendarmerie charged with collecting subjects for human experimentation.[104]

Once identified, the individuals concerned were subject to additional interrogation by the NKVD. Interviews were also conducted with civilians in Harbin who had knowledge of Unit 731. The Soviets were quickly able to identify those military figures they held in captivity who had played lead roles in Japan's offensive BW programme in Manchuria and China. Eventually, these personnel were transferred to a prison in Khabarovsk before facing trial for their role in the manufacture and employment of biological weapons. High-ranking investigators are then reported to have arrived from Moscow, with interrogations being conducted between nine and twelve o'clock each morning.[105]

The trial eventually took place between 25 and 30 December 1949. Among those charged under Article 1 of the 19 April 1943 Decree of the Presidium of the USSR Supreme Soviet ('On Measures of Punishment for the German-Fascists Villains Guilty in Murders and Tortures of Soviet

Civilians and Imprisoned Red Army Military, for Spies, Traitors to the Fatherland from among the Soviet Citizens and Their Accomplices') were: General Otozō (former commander-in-chief of the Kwantung Army); Lt-General Kajitsuka Ryuji (former chief of medical administration of the Kwantung Army); Lt-General Takahashi Takaatsu (former chief of the Veterinary Service of the Kwantung Army); Major-General Kawashima Kiyoshi (former chief of a department of bacteriological Unit 731); Major Karasawa Tomio (former chief of a section of Unit 731); Lt-Colonel Nishi Toshihide (former chief of a department of Unit 731); Major Onoue Masao (former chief of a branch of Unit 731); Major-General Sato Shunji (former chief of Medical Service, 5th Army); Lt Hirazakura Zensaku (former researcher of Unit 100); Senior Sergeant Mitomo Kazuo (former member of Unit 100); Corporal Kikuchi Norimitsu (former medical orderly of Branch 643 of Unit 731); and Kurushima Yuji (a former laboratory orderly of Branch 162 of Unit 731).[106]

In his review of issues arising from the Khabarovsk trial, Yudin argues that 'from the very beginning of preparation of the trial it was predetermined that defendants would not get severe punishment'.[107] Given the nature of the crimes committed, the sentences do appear to have been relatively lenient. On 30 December 1949, the defendants were found guilty and sentenced to terms ranging from two to twenty-five years in Soviet labour correction camps.[108] In fact, the Soviet authorities never even proceeded with the committal to the camps. Instead, on 12 March 1950, Yamada, along with the officers, doctors and other personnel from Unit 731, was transferred from a camp in Ussuriisk (then called Voroshilovsk) to the comparative comfort of the NKVD special prison camp No. 48 located in Cherntsy (Ivanovo region). This site, to the north-east of Moscow, is only some 53 kilometres from Suzdal where, in the 1930s, Soviet scientists were imprisoned by OGPU and forced to work on the Soviet Union's own BW programme. At Cherntsy, the Japanese prisoners occupied the former Voykov Sanatorium for Railway Employees, itself having once been a tsarist-era red-brick manor house. Some fifty Japanese prisoners were held at the site, which was guarded by Red Army officers along with NKVD linguists. The sanatorium was surrounded by a high fence, each side of which had a 2-metre control strip and barbed wire.[109]

Releases of cooperative Japanese BW prisoners of war appear to have begun as early as 1953. The remaining captives appear to have been repatriated following the signing on 19 October 1956 of the Soviet–Japanese Joint Declaration, and the accompanying decree of the Presidium of the USSR Supreme Soviet 'On Early Release of Convicted Japanese Citizens and Their Repatriation'. Soviet archives reveal that it was precisely at this moment, on 20 October 1956, that Major Karasawa Tomio (former chief of a section of Unit 731), chose to commit suicide rather than face the humiliating return to Japan.[110]

The leniency with which the Japanese BW specialists were treated—the longest sentence any served was seven years—has led a number of scholars to conclude that some sort of deal was struck between the Soviet authorities and the Japanese BW personnel held captive in the USSR. The USSR would have been fully aware of the U.S. immunity-for-data deal agreed with Ishii and other senior officers from Unit 731. Presumably, in the same way, the Unit 731 and Unit 100 captives held in the USSR had agreed to fully cooperate with the Red Army in return for more lenient treatment. The Russian researcher Yudin puts forward the case made by Evgenii Sholokh that Stalin's treatment was so mild because 'it was made in exchange for very useful information disclosed by the Japanese prisoners ... Otherwise, it would be difficult to understand such humaneness [from] the Soviet justice and special services.'[111] It is just possible, as was the case with Ishii Shirō in the United States, that the deal went beyond the mere sharing of information. In April 1948, the US 441st Counter Intelligence Corps, part of a Second World War and early Cold War intelligence agency within the United States Army, noted that thirty members of Unit 731, captured in Manchuria by the Red Army, were working on a bacteriological research project near Moscow.[112] As ever, the release of further information is awaited from the Russian archives before any attempt can be made to verify this US report. Some of the information gleaned from the Japanese may have been used in the design of a new army BW facility, the Scientific-Research Institute of Hygiene, in Ekaterinburg (then named Sverdlovsk) in 1947.[113]

The secrecy surrounding the Soviet Union's interaction with former scientists from Unit 731 appears to have persisted at least until the early 1970s. Igor' Valerianovich Domaradskii, a leading scientist in the Soviet offensive BW programme, recalls that in 1973 he approached Nikolai Nikolaevich Zhukov-Verezhnikov, a member and vice-president of the USSR Academy of Medical Sciences, with regard to obtaining technical details on Unit 731's large-scale cultivation of bacteria and fleas. Zhukov-

Verezhnikov had appeared at the Khabarovsk trial as a medical expert and might be expected to be aware of the location of this data. Domaradskii reports that Zhukov-Verezhnikov would not provide any information relating to Unit 731 and concludes 'That the veil of secrecy that has been thrown here over the proceedings of the case in Khabarovsk therefore seems suspicious in retrospect.'[114]

Finally, mention should be made of the opportunities presented to Soviet BW specialists during their participation in post-war USSR missions to Japan. From 1946 to 1948, for example, Vladimir Yakovlevich Podolyan served as a medical advisor to the Union Council for the Control of Japan. It is reported that in this position 'He both knew and understood well the significance of the work carried out in Japan concerning the preparation and introduction of bacteriological warfare'. Podolyan presumably followed-up leads identified during the interrogations of Unit 731 personnel held captive by the Soviet Union. He later also returned to the USSR from Japan with several viable strains of the Japanese encephalitis virus. From 1959 to 1966, Podolyan, by this time a colonel, served as head of the USSR Ministry of Defence's Scientific-Research Sanitary Institute (Zagorsk).[115]

10

STALIN'S BW ARCHIPELAGO

MAPPING-OUT A NEW POST-WAR BW NETWORK

Beria's control of Soviet BW facilities, 1946–53

During the immediate post-war period, Lavrentiy Beria, the Soviet minister of internal affairs, continued to maintain control of the Soviet BW programme and to further develop its offensive capabilities. Beria was at this time a full member of the Soviet Politburo and exercised general control over national security matters as both deputy prime minister and curator of the Organs of State Security. He already had experience of managing WMD projects since in December 1944 he had been assigned responsibility for supervising the Soviet atomic bomb project. In his new role as chief of the Soviet BW programme, Beria and his staff had access to biological weapons specialists captured as a result of the Soviet victory in the Second World War. As detailed above, workers at the vast BW complex at Pingfan (in the suburbs of Harbin), for example, which lay at the heart of the massive Japanese offensive BW programme, were singled out for capture and interrogated by the Soviet security services.[1] Technologies of considerable value to the Soviet BW effort appear to have been procured as a result.

A key member of staff working directly under Beria was Petr Nikolaevich Burgasov. Burgasov was born on 29 January 1915 in the town of Tula, 193 kilometres (120 miles) south of Moscow. Initially, he had been employed as a metal worker in the local arms factory. This was a time when the Soviets were attempting to make professional education open to the proletariat, and Burgasov engaged in studies in the evenings at a workers' school (*rabfak*). In 1933, he entered the Second Moscow Medical Institute. In 1938, Burgasov enrolled as a postgraduate in the A.M. Gorky All-Union Institute of Experimental Medicine. Here, he was engaged in work on dangerous pathogens including plague, tularaemia and so on. After the arrest of his supervisor, Academician Pavel Feliksovich Zdrodovskii, he was placed under the charge of Leonid Moiseevich Khatenever, the former director of the Red Army's Biotechnical Institute, which had been engaged in offensive BW research on Gorodomyla Island. Burgasov subsequently enlisted and led a regimental sanitary service in the Soviet–Finnish War (1939–40) and served as an epidemiologist in the Second World War. After the war, Burgasov was appointed as a senior inspector of a department in the USSR Ministry of Defence's Main Military-Medical Administration.

From April 1950 to 1953, Burgasov worked directly under Beria. He was employed in a group headed by Vasilii Alekseevich Makhnev, which was focused on biological weapons, including the defence of the population and armed forces from biological attack. Interestingly, Makhnev was at this time a key player in the Soviet atomic weapons project.[2] According to Burgasov, he prepared monthly reports for both Stalin and Beria on BW development in both the Soviet Union and abroad.[3] He also reports that no other individuals were to be informed of any details regarding the programme's work. Burgasov later recalled how after one particular BW field test, he allowed one of his junior KGB employees to return home a day earlier than had originally been planned. The same individual then reported on the test to his own KGB superior officer. Beria apparently learnt of this breach of security and summoned Burgasov to his office for a reprimand. The fate of the junior KGB officer is not known.[4]

Kirov: The hub of Stalin's post-war BW programme

In the post-war period, Beria maintained the NIIEG facility at remote Kirov as the key hub of the Soviet BW programme. Major-General Kopylov remained director of the Scientific-Research Institute of

Epidemiology and Hygiene. Some glimpse into the power struggles then underway at Kirov can be glimpsed from the following incident. In 1945, Kopylov led a group of military personnel to a microbiology conference in Moscow where they met Efim Il'ich Demikhovskii (see Chapter 3), the former deputy director of the Red Army's Biotechnical Institute. Kopylov is reported to have attempted to persuade Demikhovskii that he should initiate a case claiming co-authorship of a new human anthrax vaccine, work solely credited to Nikolai Nikolaevich Ginsburg. In his memoirs, Demikhovskii states that because of this 'I realised what a row was taking place in this institute.'[5] Clearly, there was little love lost between Ginsburg and Kopylov, both of whom would soon be transferred to a new modern BW facility being created in Sverdlovsk.

Kopylov was replaced as director in 1949 by General Nikolai Ivanovich Nikolaev (doctor of medical sciences). Together with a number of colleagues from the institute, Nikolaev was subsequently transferred to become the new director of the Mikrob Scientific-Research Anti-Plague Institute (Saratov) where he installed a new production line for plague vaccine.[6] His replacement as director in 1951 was V.D. Neustroev (candidate of medical sciences). In 1955, P.A. Ogurtsov (candidate of medical sciences) was appointed director at Kirov. Vitalii Vasil'evich Skvortsov served as director from 1957 to 1973.[7] He therefore linked Stalin's initial offensive BW programmes to those subsequently launched in the 1970s by Biopreparat in conjunction with the Soviet Ministry of Defence, Ministry of Agriculture, the Academy of Sciences and other civil agencies.

Few details have emerged in Soviet or later Russian publications regarding the research programmes pursued by NIIEG in the immediate post-war period. A CIA study in 1961 reported a probable emphasis by NIIEG on properties of bacterial pathogens in the dry aerosol form and noted that by 1947 the military institute had developed its own freeze-drying unit.[8] NIIEG's research programme is likely to have undergone a significant upheaval when, in the same year, Beria initiated a major reorganisation of the institute.

The Soviet émigré Popovsky notes that NIIEG was originally located on the outskirts of Kirov. However, eventually,

> Kirov had expanded to such an extent that the former hospital with its concrete enclosure and its store of deadly infection stood in the very

> centre, a stone's throw from the party's regional and executive committee offices. The general layout resembles a set of nesting dolls: the city of Kirov is on the outside, then comes the Bacteriological City guarded by regular troops, and then, within a further enclosure, the actual production unit, protected for greater safety by troops of the KGB.[9]

Identification by UK intelligence of Kirov and Vozrozhdenie BW facilities: A new focus on plague

In the immediate post-war period, captured German intelligence officers provided the West with much new material relating to the Soviet Union's biological warfare programme. One of the key informants was Dr Walter Hirsch, a German CW expert who had once been chief of the CW section of the German Army Ordnance Development Department (WaPrüf 9, OKW). However, while they had been aware of BW activities at the test site on Vozrozhdenie Island, the Germans appear to have had no knowledge of the relocation during the war of military biological facilities to Kirov.[10] It was a series of forty intercepts, beginning in October 1947, of Soviet communications by the UK's recently established Government Communications Headquarters (GCHQ) that led to the first identification of the top-secret facility. This communications intelligence (Comint), of which only a tiny proportion has been released, carried the code word COPSE.[11] GCHQ succeeded in identifying the NIIEG and its location at 53, Oktyabr'skaya ulitsa in Kirov. Among the key personnel identified by British intelligence at Kirov were Kopylov, Faibich and Ginsburg. The amount of detail discovered by GCHQ can sometimes astonish. In November 1947, for example, GCHQ intercepted a message from Faibich confirming his safe arrival at the Voroshilov Sanatorium in Sochi. Another message from Kirov congratulated a scientist based on Vozrozhdenie on the birth of his son.[12]

Interrogation of captured German chemical weapons experts had already provided Western intelligence with information on the Soviet pre-war use of Vozrozhdenie Island as a biological test site. Since then, UK intelligence had been successful in intercepting a number of messages suggestive of continuing illicit activity underway on the Aral Sea island. On 17 March 1947, for example, the USSR Ministry of the Fish Industry for Western Areas approved the transport of fish from fishing boats for delivery to processing factories at Mo'ynoq and Kazakdar'ya 'through the forbidden zone'. In April 1947, a forestry official noted that there was a prohibition on hunting in the Aral Sea region. Restrictions were also placed on fishing close to the shores of Vozrozhdenie Island and nearby Chagal (or Kagyl) Island. The later COPSE intercepts, beginning in October 1947, allowed the British to confirm that this pivotal Aral Sea base remained in use and was subordinate to NIIEG. The lead scientists on Vozrozhdenie were identified as Semen Timofeevich Drab and Nikolai Fedorovich Kapitov.[13]

The GCHQ material provides some fascinating insight into the nature of activities underway at this time in Kirov and its Vozrozhdenie satellite. One of the tasks assigned to the Aral Sea base by Ginsburg was the collection of 300 *susliks* (ground squirrels), which were to be despatched to Kirov at some point after 1 September 1948.[14] This was followed in January 1949 by a request from Kopylov, the then head of NIIEG, of the 'urgent necessity' for Drab to procure an additional 350 *susliks* from Vozrozhdenie by 1 August.[15] The focus on *susliks* is extremely interesting and suggests that the Soviet military were interested in the plague strains hosted by this rodent. It should also be borne in mind that, in the summer of 1937, the Soviet military is reported to have delivered thousands of squirrels to Vozrozhdenie Island 'of a variety whose fleas were capable of transmitting plague'.[16] It would appear to be a possibility that these animals may at that time have been exposed to aerosols containing strains of pneumonic plague. A decade after the completion of these trials, Ginsburg and his colleagues in Kirov may very well have been interested in harvesting the descendants of the original experimental animal population to determine which plague strains were now present.

The United States had also correctly deduced that BW research was underway at the military facility in Kirov. An undated US intelligence document notes that, before 1948, a group of researchers at the Scientific-Research Institute of Epidemiology and Hygiene in Kirov published a number of papers dealing with aspects of only four diseases, namely tularaemia, brucellosis, anthrax and plague. The report noted that these publications ceased in 1948, and the authors' names did not then reappear in publications from other locations, presumably because all subsequent work remained highly classified.[17]

The creation of new BW facilities in the post-war period

Sverdlovsk (present-day Ekaterinburg)

NIIEG's post-war status as the Soviet Union's sole dedicated BW institution was soon to change with a major expansion of Stalin's BW archipelago. During the period 1947 to 1949, a new military BW facility was spun off from the Kirov institute. It was allocated the former site of the Cherkassk-Sverdlovsk Infantry Academy in Sverdlovsk on Ulitsa Zvezdnaya, 1, and abutted the sourthern industrialised sector of the city.[18] Known as the USSR Ministry of Defence's Scientific-Research Institute of Hygiene, it became operational on 19 July 1949.[19] Several laboratories and associated personnel of the Scientific-Research Institute of Epidemiology and Hygiene were transferred from Kirov to Ekaterinburg. The first group, together with the first director of the Scientific-Research Institute of Hygiene, Kopylov, arrived in September 1949. The first scientific director of the new facility was Colonel Ginsburg, who was also transferred from Kirov. A leading expert on anthrax, Ginsburg was a doctor of medical and veterinary sciences and had been awarded the Stalin Prize.[20] In 1951, a scientific programme was launched at the Scientific-Research Institute of Hygiene that focused on botulinum toxin. Kopylov participated in work on aerosols and mass immunisation.[21] In 1952, Kopylov retired as director of the Scientific-Research Institute of Hygiene. During the period 1952 to 1953, E.I. Polosin was director. He was replaced by Professor Yu.M. Volynkin, who served from 1954 to 1958.

US intelligence appears to have deduced that the Soviets had spun-off a new BW facility from the Scientific-Research Institute of Epidemiology and Hygiene (Kirov). A report issued by the US Joint Biological Warfare Intelligence Committee in October 1949 correctly asserted that a group of scientists at this new entity was being led in research and development of biological weapons by Ginsburg. However, the report mistakenly located the new facility at or close to Samara, then named Kuibyshev (53°10'N–50°10'E), a port located on the River Volga, 146 miles north-east of Shikhany.[22] In December 1949, a GCHQ report also identified a group of leading Soviet BW specialists as having been engaged in research at the Soviet Army's Sanitary Hygienic Research Institute in Kuibyshev. It too identifies Ginsburg as a leading figure.[23]

Zagorsk (present-day Sergiev Posad)

After the conclusion of the Second World War, it rapidly became apparent that the armed forces could no longer rely upon the use of horses as cavalry or for transportation. As a result, the military's veterinary R&D programme was greatly scaled back, and in 1949 the facilities at Zagorsk belonging to the Red Army's Veterinary Scientific-Research Institute were transferred to the USSR Ministry of Health.[24] A new All-Union Scientific-Research Institute of Vaccines and Sera (Nauchno-issledovatel'skii institut vaktsin i syvorotok or VNIIVS) was quickly established on the basis of the military veterinary labs. A number of heads of laboratories and scientific personnel, including several bacteriologists, biochemists and histologists, from the former Zagorsk military veterinary institute, remained on site and transferred over to the new facility.[25]

The subordination of VNIIVS to the USSR Ministry of Health meant that the new facility fell under the control of Colonel-General Smirnov (doctor of medical sciences). As has already been detailed, Smirnov was a pivotal figure in the development of the Soviet Union's biological warfare capability from 1939 to 1985. During the period 1939 to 1946, Smirnov headed the Red Army's Main Military-Sanitary Administration, which had a major input into the Soviet Union's biological weapons programme.[26] From 17 February 1946 to December 1952, Smirnov served as head of the USSR Ministry of Health and therefore exerted control over VNIIVS.[27]

The new director of VNIIVS was Dr Andrei Alekseevich Sinitskii. He had previously been employed as a doctor in the Pskov region before, in 1928, being employed within the Department of Bacteriology at the Leningrad Institute for the Improvement of Doctors. Sinitskii defended his candidate's dissertation in 1937 and from 1940 to 1949 was director of the Leningrad Scientific-Research Institute of Vaccines and Sera. Sinitskii would later go on to become head of the Department of Microbiology at the Leningrad Military-Medical Academy. His main scientific focus was on streptococcal infections.[28] In 1950, Anatolii Timofeevich Kravchenko, a virologist, was appointed as Sinitskii's deputy. Kravchenko had previously worked as director of the Soviet Union's first dedicated virology facility, the USSR Academy of Medical Sciences' D.I. Ivanovskii Institute of Virology (Moscow).[29]

Kravchenko was joined by one of the founders of the D.I. Ivanovskii Institute, A.I. Yakovlev.[30] Another virologist appointed to the new institute was M.K. Karakuyumchan. In 1951, a number of new graduates from the First Moscow Medical Institute, including V.A. Genig, V.F. Ignatovich, A.G. Markaryan, M.I. Klimanova, L.V. Minakova and V.S. Samsonova also joined VNIIVS. However, even the authors of the official history of the institutions currently based at the Sergiev Posad site are forced to admit that, while it is known there was a medical R&D focus, no significant details of its scientific activities are currently available. Whether this is because of the loss or destruction of historical records or is due to the information remaining classified is unknown. This loss of institutional memory relating to BW activities undertaken during the Soviet period is not confined to VNIIVS and highlights the obstacles facing historians seeking to document Russia's past biological warfare programmes.

In early 1952, under the terms of a special government decree, VNIIVS was reorganised as a closed facility and renamed as the Scientific-Research Sanitary Institute (NII Sanitarii or simply NIIS). Although officially remaining under the USSR Ministry of Health, the institute was one of number of BW facilities at this time that was actually controlled directly by Beria. The institute is reported to have initially been focused on developing toxoids against botulism, tetanus and gas gangrene.[31]

On 29 September 1953, the USSR Ministry of Defence issued Order No. 00180 concerning the transfer of NIIS to its control. The reorganisation of the facility was completed on 15 March 1954 and it then began recruiting the appropriate officers and specialists. The institute continued its research on botulinum toxoids. However, it was also entrusted with responsibility for military research on viruses. In 1954, Mikhail Ivanovich Kostyuchenok, by this time a general, was selected by Smirnov (the head of the recently formed Seventh Directorate of the General Staff of the USSR Ministry of Defence) to be the first head of NIIS. During the Second World War, Kostyuchenok had served as head of the Medical Service of the Western front. In the immediate post-war period, he was head of the Belarusian military district. From 1951 to 1954, Kostyuchenok was head of the Main Military Hospital (now known as the N.N. Burdenko Clinical Hospital). Subsequently, Smirnov reports that he 'did not regret recommending Mikhail Ivanovich for a more responsible position. He coped well with it.' Commenting on his character, one author recalls that Kostyuchenok 'not infrequently flavoured his speech with juicy words, albeit not always entirely accurate in meaning, which nevertheless made his speeches vivid, intelligible and memorable'. A contemporary of Kostyuchenok reports that he was a bureaucrat and that research and production affairs were in fact the responsibility of the deputy head of the institute, Kravchenko. Professor Kravchenko is reported to have been a leading Soviet virologist at this time.[32]

Early research programmes on BW agents at Zagorsk settlement appear to have paralleled those underway at Fort Detrick in the United States. For example, research, including aerosol tests, was being conducted on *Chlamydia psittaci*, the causal agent of psittacosis or parrot fever.[33] At the time, this agent was considered the most powerful of the 'incapacitant' weapons, since it would produce a high fever, which could later develop into pneumonia. If virulent strains of this organism were utilised, it is estimated that around one in five human victims would die. Military scientists were also engaged in research on shrub typhus caused by the agent *Rickettsia tsutsugamushi*. Tsutsugamushi fever was a disease investigated by the Japanese BW programme, and it is possible that the Russians gained knowledge of the biological weapons' potential of *R. tsutsugamushi* from captured Japanese scientists or documentation.[34] Researchers at the facility are also reported to have worked on the protozoan parasite *Trypanosoma cruzi*, the causative agent of Chagas disease. Commonly, patients infected with this organism enter a symptomless phase lasting several months or years, during which time most of the organs of the body are invaded, leading to heart, intestinal and oesophageal damage and progressive weakness.[35]

A key toxins' specialist to be transferred to the institute in this early period was Anatolii Andreevich Vorob'ev, who joined the Zagorsk facility in 1956 from the Military-Naval Medical Academy (VMMA).[36] He worked initially as a senior researcher. During the period 1956 to 1978, Vorob'ev rose from the position of deputy head of a scientific-research department to become deputy head of the Centre for Scientific Work. Vorob'ev was subsequently awarded the USSR State Prize. Vorob'ev led research in Zagorsk on *rickettsias* including Q-fever (*Coxiella burnetii*), which was being developed in the United States as a standardised weapon. He also worked with L.A. Klyucharev on viral genetics. Vorob'ev is reported to have been working on smallpox in the early 1970s and may have been a key figure in transferring the egg-based production technology to the Pokrov Factory of Biopreparations. He was promoted to major-general of the Medical Services in 1975. In 1978, Vorob'ev was transferred to the Main Administration of the Microbiological Industry (Glavmikrobioprom), where he was employed as the deputy head of the Main Administration for Scientific Work.[37] Subsequently, he was appointed as first deputy director of Biopreparat, an ostensibly civilian organisation, which in fact was a lead agency in the Soviet offensive BW programme of the 1970s and 1980s.[38]

Reactivation of Vozrozhdenie Island as an open-air BW test site

The Soviet military is reported to have taken the decision to undertake a massive expansion of its open-air BW proving ground on Vozrozhdenie Island and on nearby Komsomol' Island in 1952. Two years later, in 1954, the same year as the creation of the Scientific-Research Sanitary Institute at Zagorsk, construction is reported to have begun of a secret base known officially as Aral'sk-7. It incorporated a small landing strip, housing for staff and a laboratory complex (the 52nd Field Scientific Research Laboratory or 52-ya polevaya nauchno-issledovatel'skaya laboratoriya, abbreviated to PNIL-52) possessing a high-containment unit.[39] In addition, Military Unit No. 25484, which comprised several hundred people, was based on the island and was part of, and subordinate to, a larger unit based in Aral'sk, Kazakhstan.[40] This unit itself was subordinate to the Ministry of Defence's virology centre at *67-i km* settlement, Sergiev Posad. The total population on the island was eventually to exceed more than 1,000.[41]

It may be the case that other islands in the Aral Sea were subsequently exploited by the Soviet military. In 1956, for example, the CIA reported that the Military Medical Academy (Leningrad) had conducted tests in a desolate area of the Aral Sea very close to Vozrozhdenie Island. The work involved a series of field experiments to control fleas via hexachlorine aerosols. It may have been the case that the VMA scientists were not permitted to have free access to the island. Alternatively, 'the extreme isolation of the field camp may have been dictated by the desire to employ plague infected fleas. Programme scheduling or various other factors may also have precluded the use of Vozrozhdenie'.[42]

The CIA identified Konstantin Island, some 3 miles to the south of Vozrozhdenie, as probably being associated with the BW test programme. The agency was unable to determine the precise role it played.[43] A separate source reveals that, in 1960, an accident resulting from a shift in wind direction during BW testing on Konstantin Island led to an emergency evacuation and widespread contamination. In the wake of this incident, the island was never used again for BW tests.[44]

In April 1961, the CIA's authoritative report on the Soviet BW programme provided a very useful conjectural overview of the historical development of BW agents in the USSR and the role played by Vozrozhdenie Island:

> A broad conjectural view of agent development in the USSR, beginning with the activities of Velikanov's Institute in the mid-1930s, suggests a sequence of steps, or phases, which culminated in the elaborate test programme probably undertaken on Vozrozhdenie Island. During the early years, in the thirties, a preliminary and perhaps haphazard, screening of potential agents was conducted. Botulinum toxin, one or more of the animal viruses, and several pathogens of humans were investigated in the laboratory and disseminated in primitive field trials at the Aral Sea installation. With the establishment of NIIEG [Red Army's Scientific-Research Institute of Epidemiology and Hygiene, Kirov] serious efforts were made to assess the BW properties of selected candidate agents. In what may be categorized as phase I, a variety of infectious bacteria and their toxins were screened for effectiveness in aerosol form against experimental animals. In phase II, a technology was devised for processing large quantities of at least four of these to a state suitable for agent purposes: anthrax, plague, tularaemia, and brucellosis. Presumably some, or all of them, were investigated on Vozrozhdenie Island during this period. In the late 1940's and early 1950's NIIEG's attention was diverted, in a third phase, to screening the potentially good virus agents for use against man … Little significant progress was made in development of viral agents before NIIEG was supplanted by a still unidentified agency whose current programme places emphasis on viral and *rickettsial* forms for use against humans and animals … At some point in this speculative but plausible series of events, the union of candidate biological agents to dispersing devices was apparently made on Vozrozhdenie Island.[45]

11

FROM SWORDS TO PLOUGHSHARES

THE SCIENTIFIC AND INDUSTRIAL ACHIEVEMENTS OF STALIN'S BW ARCHIPELAGO

A number of long-range research programmes were initiated by the Red Army's BW facilities which would bring about the development and application of a range of civil and defence vaccines during the Second World War. As a result, 8.5 million Soviet troops were vaccinated against plague, 90,000 against anthrax and an unknown number against tularaemia. In addition, botulinum toxoids and a vaccine against brucellosis were developed. Stalin's military-biological facilities also claimed to have made a critical contribution to the creation of a national industry for the manufacture of antibiotics. The military was also engaged in research focused on the development of therapeutic bacteriophage. This chapter attempts to assess the real contribution of Stalin's BW archipelago to the development of these critical healthcare technologies.

Tularaemia vaccine

In conjunction with another arrested scientist, Nikolai Akimovich Gaiskii, Boris Yakovlevich El'bert is reported to have undertaken an extremely thorough study of tularaemia infections and the mechanisms of immunity from it, as well as into changes of the tularaemia microorganism. During the period 1934 to 1936, they worked on the development of a live attenuated tularaemia vaccine. In 1934, they inoculated animals with a weakly virulent tularaemia culture. Protection was demonstrated when these immunised animals were challenged with a virulent culture, and it was suggested that the same immunisation procedure might be applicable to humans. Gaiskii and El'bert eventually succeeded in attenuating a natural isolate of *Francisella tularensis*, strain Moscow (also known as the El'bert–Gaiskii strain), into a safe and effective vaccine. This is initially reported to have been successfully tested on thirty-four volunteers. A live tularaemia vaccine prepared by Gaiskii and Elbert subsequently underwent trials at the Stalingrad front. A public health commission then approved NIIEG's instructions for the manufacture of the preparation. The Gaiskii and El'bert tularaemia vaccine was introduced for mass vaccination in the Soviet Union in 1946.[1] More than sixteen million doses of tularaemia vaccine appear to have been produced by NIIEG during the period 1944 to 1953.[2]

In 1937, both El'bert and Gaiskii were released from their service in the Red Army. El'bert was exiled to Frunze (present-day Bishkek) to be director at the newly opened Kyrgyz Microbiological Institute. However, this facility was not in possession of any certification for work with highly pathogenic microorganisms, and he was forced to suspend his work on tularaemia. It was not until 1945, when El'bert was appointed deputy director of the Rostov-on-Don Institute of Epidemiology and Microbiology and a scientific consultant at the Rostov-on-Don Anti-Plague Institute, that he could resume his previous studies. Gaiskii meanwhile was appointed head of the Ashkhabad Anti-Plague Station and then from 1939 until 1947 served as deputy director of the Irkutsk Anti-Plague Institute of Siberia and the Far East. Here, he was able to use the knowledge accumulated within the OGPU and Red Army facilities to resume his experiments on the tularaemia vaccine.

The senior management at the Irkutsk Anti-Plague Institute are reported to have taken advantage of the suspension of El'bert's research to claim that the new tularaemia vaccine was 'Gaiskii's vaccine'. Despite the claim, the contribution of both El'bert and Gaiskii to the development of the preparation was recognised by the award of the Stalin Prize. However, at the national conference on tularaemia that was held in 1946, scientists from the Irkutsk institute accused El'bert of seeking to falsely represent himself as a co-developer of the discovery. El'bert is reported to have addressed the meeting to claim that the two scientists jointly developed the vaccine, but Gaiskii then failed to speak-up in support of his former colleague. El'bert was unable to prove his claim because all the manuscripts and papers concerning the research had been retained by the military. Moreover, upon their release, both he and Gaiskii had signed a secrecy agreement concerning their work at the Suzdal *sharashka* (see Chapter 2).[3]

It was not until the 1960s that an unnamed professor attached to the RSFSR Ministry of Health Administration of Sanitation and Epidemiology's Tularaemia Committee discovered an old manuscript written by El'bert and Gaiskii. The paper is reported to have originated from the Suzdal *sharashka* where the two scientists were imprisoned and had begun their joint work on the development of a tularaemia vaccine. After the release of the scientists, this paper, along with other documentation prepared by El'bert and Gaiskii, had been retained by the Red Army and eventually been transferred to the USSR Ministry of Defence's Scientific-Research Sanitary Institute in Zagorsk in Moscow oblast'. The head of the Tularaemia Committee, one Nikolai Grigor'evich Olsufyev (head of the Tularaemia Laboratory at the N.F. Gamaleya Scientific-Research Institute of Epidemiology and Microbiology, Moscow) then made a copy of the document and this was presented to El'bert at one of its meetings. El'bert was reported to be overcome with emotion because he feared the paper had been forever lost. Olsufyev subsequently sent a copy to the Irkutsk Anti-Plague Institute together with a covering letter from the Ministry of Health.[4]

El'bert and Gaiskii's work may also have had an offensive aspect. The strain of tularaemia created with their participation was extremely virulent and stable. By 1941, it may have been used to create weapons based on the tularaemia bacterium, although additional evidence for this assertion is lacking.

Development of the STI anthrax vaccine

The military development of a live spore STI-1 vaccine against anthrax and its subsequent utilisation by the Russian health and veterinary services is well documented in recent publications. It was one of the first and most significant transfers of technology from military microbiological facilities to the civilian bioindustry. As we have seen, Russia already possessed a two-stage veterinary anthrax vaccine originally developed by Lev Semenovich Tsenkovskii in 1884 using a method elaborated by Pasteur.[5] One of the first industrial production sites of the Tsenkovskii vaccine was at the Kursk Biofactory, which was commissioned and began output of the anthrax vaccine in January 1896 (see Chapter 8).[6]

In 1935, the Red Army's facility in Vlasikha was assigned the task of developing a human anthrax vaccine. Officially, the decision to embark upon this project was prompted by fears that anthrax might be employed against the Soviet Union's troops and/or the civilian population. The authorities also expressed the wish to reduce the very high incidence of human anthrax in various regions of the Soviet Union at that time.[7] Before the Second World War, for example, there were as many as forty cases of anthrax per 100,000 head of population in Azerbaijan, with similarly high incidences in Kyrgyzstan and other parts of Central Asia.[8] Concomitantly, it was also an extremely necessary adjunct to the Soviet offensive anthrax programme.

The first anthrax vaccine to be developed by the military microbiologists was in fact to find widespread application in the Soviet Union's livestock sector. In 1940, a team of researchers led by Ginsburg and A.L. Tamarin at the Sanitary-Technical Institute (Sanitarno-Tekhnicheskii Institut or STI) successfully derived two avirulent non-encapsulated *Bacillus anthracis* strains, STI-1 and *GIEV-III* from virulent parents by culture in coagulated horse serum.[9] STI-1 was derived from the virulent strain *Krasnaya Niva* (Red cornfield).[10] A new live vaccine containing 25×10^7 spores of STI-1 was then developed and subsequently tested on more than two million agricultural animals.[11] After the Second World War, the military anthrax vaccine played a crucial role in reducing the incidence of anthrax in livestock in Russia and the republics.

The technology for the industrial production of the veterinary STI vaccine was transferred to a civilian industrial manufacturing facility, which enabled the number of animals being vaccinated to be increased from 38.4 million in 1947 to 140 million in 1960, with a concomitant fall in the number of cases of anthrax from 30,500 to 3,500 over the same period.[12] A 1961 CIA report noted that among the manufacturers of the military vaccine in the mid-1940s was the Kashintsevo Biofactory, north-east of Moscow. At this time, more than 40,000 litres of the preparation were produced in a two-year period by this facility and others.[13]

The use of the military anthrax vaccine had not, however, been without problems. In 1982, inoculation with contaminated STI vaccine manufactured by the Orel Biofactory (subordinate to the Russian Ministry of Food and Agriculture's Science Production Concern Rosagrobioprom) resulted in illnesses and deaths of an unknown number of cattle and sheep.[14] Besides specific incidents such as this, it was also found that not all animals injected with the vaccine developed immunity, and for those which did, it was sometimes of short duration. As a result, it was recommended that in certain regions animals should have two shots of the vaccine (in spring and autumn), which was both wasteful and expensive.[15] Moreover, since the 1950s the more widespread use of STI vaccine did not lead to an appreciable decline in the number of cases of anthrax in the human and animal population, and there had been a recurrence of the disease in animals in the immediate period after inoculation. The deficiencies of the military veterinary vaccine led more recently to its replacement by a new and more effective preparation against anthrax developed by a team of researchers working at the Russian Ministry of Food and Agriculture's All-Russian Scientific-Research Institute of Veterinary Virology and Microbiology in Pokrov (Vladimir oblast').[16]

The military research team also succeeded in their original aim of creating an anthrax vaccine for human use. In 1943, Ginsburg and Tamarin, now working in Kirov where the Scientific-Technical Institute (STI), operating under its new name, the Scientific-Research Institute of Epidemiology and Hygiene, had been evacuated in the face of the continuing German advance, developed a human live anthrax vaccine based on a mixture of spores of the STI-1 and GIEV-III non-capsulating strains. The new vaccine was administered via skin scarification (91.3×10^8 spores) or sub-cutaneous injection (5×10^7 spores). The production of the vaccine was organised in the Kirov facility, and before the invasion of Romania, 90,000 servicemen were inoculated with this preparation. Ginsberg and Tamarin were awarded the USSR State Prize for this work in 1945.[17] This was followed in 1951 to 1952 by a successful field trial in Moldova involving vaccination of 141,663 individuals. These results led the USSR Ministry of Defence to licence the human STI vaccine for administration by scarification in 1953 and by subcutaneous inoculation in 1959.[18]

It is reported that the efficacy of the *STI* vaccine is greater than that of the killed (non-live) US or British vaccines. It is not known if the *STI* vaccine gives protection against an anthrax aerosol, but it is probable that animal experiments to test the efficacy of the preparation in these conditions were conducted by the Soviet military.

Transfer of STI anthrax vaccine production to Tbilisi

Ginsburg subsequently played a major role in transferring the technology for the industrial production of the human STI vaccine to facilities belonging to the civil bioindustry. During the early 1950s, he visited the USSR Ministry of Health's Tbilisi Scientific-Research Institute of Vaccines and Sera (Nauchno-issledovatel'skii institut vaktsin i syvorotok) on a number of occasions and assisted with commissioning a new facility for the production of STI anthrax vaccine.[19] The institute in Tbilisi had previously been in receipt of large-scale financial support from Stalin, himself a Georgian, and the Soviet government. The facility had originally been created in 1923 by a Georgian microbiologist, Georgii Grigor'evich Eliava, who had returned to Tbilisi (then known as Tiflis) after working at the Pasteur Institute in Paris and assisted in the formation of the Tiflis Bacteriological Institute. Eliava led a programme of research at the facility on bacteriophage and planned large-scale tests in the USSR in clinical medicine and public health.[20]

The institute achieved a major coup when it succeeded in attracting Félix d'Hérelle—the discoverer of bacteriophage—to come to work and live in Tbilisi. The Soviet government provided a substantive hard-currency payment as an inducement to recruit the world-renowned scientist. On 14 April 1936, the Council of People's Commissars issued a decree that reorganised the facility as the All-Union Bacteriophage Institute. It was envisaged that the new institute would become a world centre for bacteriophage research. These plans were thwarted when, in 1937, Eliava was arrested and falsely accused of deliberately infecting children in the Georgian town of Signakh. Both Eliava and his wife, a Polish opera singer, were executed.[21]

The transfer of military technology to Tbilisi appears to have met with success, and the facility became the sole manufacturer of human STI anthrax vaccine in the USSR. During production of the STI anthrax vaccine, each batch (60,000 to 100,000 doses) underwent tests for efficacy in guinea pigs. A minimum of twelve experimental animals would be immunised with a single dose of live spores, and then in seven to ten days these animals would be challenged with virulent anthrax strains (one of which would be the Tsenkovskii strain). A control group of animals (minimum of twelve) that had not been immunised would also be utilised in tests against the virulent strains. The tests were undertaken both in Tbilisi and at the L.A. Tarasevich Scientific-Research Institute for the Standardisation and Control of Medical-Biological Preparations in Moscow.[22]

The principal customer for the new vaccine was the USSR Ministry of Health. However, the USSR Ministry of Defence also sent orders regarding the supply of specific volumes of the vaccine to its own medical services.[23] Although, officially, the use of the vaccine was restricted to persons employed in high-risk occupations, immunisation was also extended to those members of the public living in endemic areas, and by the late 1960s, two million individuals were being immunised annually.[24] The vaccine was stockpiled by the USSR Ministry of Health and USSR Ministry of Defence in their own dedicated facilities, and the preparation had an official shelf-life of twenty-four months.[25]

Following the release in April 1979 of an anthrax aerosol from the USSR Ministry of Defence's BW facility in Sverdlovsk, there was an intensive vaccination campaign within the city. Around 80 per cent of the 59,000 inhabitants of the Chkalovskii District (close to the military facility) who were considered eligible were vaccinated with at least one shot of the *STI* vaccine produced at the Tbilisi Institute of Vaccines and Sera.[26] However, no *STI* vaccine was sent from Tbilisi to Sverdlovsk in the aftermath of the incident, and the local population were presumably vaccinated with preparations stockpiled by the USSR Ministry of Health or the military.[27]

EV plague vaccine

Research on the production of a live plague vaccine was begun by the Soviet military in 1936 when the EV vaccine strain was supplied by the Pasteur Institute. In 1941, a group of scientists at the Sanitary Technical Institute (STI) were the first to develop a live dry NIIEG vaccine against plague based on the EV strain. They also elaborated the technology for the production of the vaccine. Among the researchers working on this project were Faibich, R.V. Karneev, N.F. Kopylov, Yu.A. Kozlov, A.S. Grudenkov, R.A. Saltykov, I.A. Chalisov and N.I. Nikolaev.

Faibich, Chalisov and Karneev were awarded the USSR State Prize for this work in 1945.[28] The institute built a facility for the production of the new vaccine. The preparation was used to inoculate 8.5 million personnel in the Soviet Army during the period 1941 to 1945. Its most intensive use was during the Soviet invasion of Manchuria in August 1945 when no cases of plague were recorded at this time within the armed forces.[29]

Botulinum toxoids

Research on the development of preparations against botulinum toxin is reported to have been initiated at the USSR Ministry of Defence's Scientific-Research Institute of Hygiene (Sverdlovsk) in 1951. Scientists are reported to have successfully elaborated technologies for the production of botulinum toxoids of different types.[30] A UK Defence Intelligence report issued in 1967 notes that the Soviets were engaged in work on the development of multi-component vaccines, which included the botulinum A, B, C, D and E toxoids. The report was not able to identify the Soviet facility responsible for the production of the botulinum toxins and their subsequent conversion to toxoids.[31] Newly available evidence suggests that, up until 1968, one of the principal producers of botulinum toxin within the Soviet Union was the USSR Ministry of Health's Scientific-Research Institute of Vaccines and Sera (now the Eliava Institute) in Tbilisi, Georgia. When output was at its peak, facilities for the production of botulinum toxin occupied an entire wing of the institute's main building. At this time, 300–400 litres of anatoxin were being produced per annum in Tbilisi. Over a period of thirty years of research and production of the toxin, there was not a single fatality at the institute. In 1968, production of botulinum anatoxins was transferred to an unknown facility in the Russian Federation.[32]

Development of a brucellosis vaccine

Studies on the pathology of Brucella strains began at NIIEG sometime before 1940. However, in the next two decades, only an additional three scientific papers relating to the disease were released by NIIEG for open publication by the military institution.[33] In 1945, V.M. Putimov and Ginsburg at NIIEG in Kirov developed a live dry brucellosis vaccine based on strain no. 19. Experiments on calves demonstrated its safety and efficacy, and this preparation was the basis of a vaccine subsequently developed for human use.[34] Experimental vaccination of human volunteers at the institute was carried out in 1946.[35]

Published military vaccine work as an indicator of progress in BW agent research

The CIA's April 1961 report on the Soviet BW programme argues that the work on vaccines published by the Red Army's NIIEG, and its forbears, especially that touching upon bacterial pathogens, can be used as a rough measure of progress in BW agent research. Simultaneous programmes of BW agent and vaccine development are entirely feasible, and the data generated can be generally used by both the defensive and offensive strands. The report notes that, by 1946–7, four bacterial vaccines against anthrax, tularaemia, brucellosis and plague, and by analogy BW agents based on these pathogens, had successfully completed phases of screening, laboratory evaluation and process development, in preparation for the mass production of viable, dried preparations. The authors of the CIA report recognise that to largely complete this work within a decade was an impressive accomplishment.[36]

The CIA report concludes that the four diseases, namely plague, anthrax, tularaemia and brucellosis, emphasised in experiments undertaken by NIIEG, point to the:

> intensive Soviet development of their BW potential at NIIEG, a programme which probably culminated in a well-defined technology for large-scale production by the middle or late 1940's. The degree of success attained in capturing within the finished product essential BW agent properties of virulence and stability under conditions of dissemination is not known.[37]

NIIEG and the provision of antibiotics for frontline troops

A number of Russian military publications have claimed that the key contribution of NIIEG to the war effort was with regard to the organisation of the industrial manufacture of antibiotics. Several sources report that the institute began penicillin production in 1944 and that the antibiotic was shipped from this facility directly to hospitals at the front.[38] A 1961 CIA report confirms that, during the period 1944–5, a team of specialists in microbial fermentation and drying technology from NIIEG is reported to have provided assistance to the Moscow Meat Combine for the creation of facilities for penicillin production.[39] Kopylov, Ginsburg, Faibich and other researchers at NIIEG were subsequently awarded the USSR State Prize for their work on the industrial production of penicillin. In 1947, the Soviet military also claims to have developed technology for the production of streptomycin, which found application in the control of a plague outbreak that had originated in China.[40]

One should be cautious with regard to these claims by Russia's military since there is evidence available to suggest that it was in fact scientists from the United Kingdom and the United States who made critical contributions to the development of an antibiotics industry in the Soviet Union. During the war, the chemical structure of penicillin was indeed still covered by the Official Secrets Act in the United Kingdom and by its equivalent in the United States. However, its existence was widely known, and in the wake of the three-power conference in Tehran in November–December 1943, Churchill, Roosevelt and Stalin agreed that an Anglo-US medical mission, comprising of two scientists from each country, would be organised to visit Moscow and confer with Soviet specialists regarding the production and use of penicillin.[41] Howard Florey, who led the development of penicillin at Oxford University, selected Gordon Sanders, an expert on penicillin production, to accompany him, and the two departed on a military plane on 24 December 1943 from London, under conditions of the strictest war-time secrecy.[42] At the end of January 1944, Florey and Sanders eventually reached Stalingrad and were then transferred to a snow-bound Moscow airport. Their mission was to last three months, during which time they provided a wealth of scientific and technical information. They also brought with them samples of mould as well as some of their best purified penicillin extract.[43]

Much of the two British scientists' time in the USSR appears to have been spent with a leading civilian microbiologist and epidemiologist, Zinaida Vissarionovna Ermol'eva, who had organised a laboratory for the production of penicillin on a large scale at the A.N. Bakh Institute of Biochemistry in Moscow. The director of the project, however, appears to have been T.I. Balezina, who at the beginning of 1942 organised a penicillin laboratory at the All-Union Institute of Experimental Medicine (VNIIEM) in Leningrad. The Soviet scientists had previously been unable to secure the *Penicillium notatum* mould from the United Kingdom and resorted to isolating their own fungal strains. By the end of 1942, the Soviet team claimed to be producing 'Soviet penicillin' with greater antibacterial activity than its UK counterpart from a strain similar to *Penicillium crustosum*. Ermol'eva was able to conduct clinical trials of the preparation against a range of diseases, but these were very limited in scale, involving a small number of cases owing to the inability to produce the penicillin industrially.[44]

The two British specialists were shown the cultures of the Soviet mould, originally isolated by Dr Kaplan, a young female biologist, from the walls of an air-raid shelter during a German attack on Moscow. They reported that the antibacterial activity of the 'Soviet penicillin' was in fact slight compared with the strains in use in the United States and Britain but this didn't prevent Kaplan being awarded the Stalin Prize. Sanders pointed to the lack of substantive progress in the Soviet work, noting that:

> We often went to Yermolieva's laboratory and worked with her and Dr Kaplan, and helped them get the work on penicillin moving ahead. It was all new to them in the sense that they had never ever got a method of extraction going, so had not obtained effective supplies for tests.[45]

Florey presented VNIIEM with samples of the dried mould he had brought with him from the UK and then spent many days teaching the Soviet scientists the principles of extraction. Meanwhile, Sanders taught the method of assay that had been devised by Norman Heatley. Interestingly, during the course of his Moscow visit, Florey acceded to a request to visit a medical clinic attached to the Soviet military and to demonstrate the use of penicillin in the treatment of infected wounds. Among the cases the British scientist selected was a young officer whose left leg had become infected after amputation. He succeeded in culturing and identifying the infecting organism and proving its sensitivity to penicillin. Florey then demonstrated both the topical and systemic approaches to treatment with penicillin and claimed 'a very solid improvement in the young man's condition'.[46]

It therefore appears highly likely that the large-scale industrial manufacture of antibiotics in the USSR was heavily dependent upon this critical transfer of technology and know-how from the United Kingdom. There are conflicting versions regarding subsequent Soviet attempts to scale-up the production of antibiotics. There appear to have been a number of early abortive attempts aimed at industrial production of penicillin beginning in the summer of 1943 at the Factory of Endocrine Preparations. At the end of 1943, further efforts followed at Factory No. 13 and simultaneously at an unnamed endocrine preparations facility. In January 1944, presumably in the wake of the Florey visit, production appears to have been transferred to the Karpov Factory—the former Ferrein Factory. Some antibiotics were sent to the front. However, very small amounts of penicillin were actually produced through to the end of the war.[47]

Whatever the precise chronology of events with regard to the development of the large-scale production of penicillin, there appears to be very little doubt that during the war only very few Red Army personnel were treated with penicillin. Clinical trials continued but were conducted on a very small scale. By the spring of 1944, some fourteen cases of syphilis were being treated. Tests were also conducted on twenty-five wounded servicemen—'hopeless cases'—with septicaemia. In the summer of 1944, forty Red Army soldiers with sepsis were treated with penicillin, of which thirty-six personnel recovered and four died. A report issued in 1945 describes how fifty-seven soldiers with ulcerous infections underwent treatment with penicillin combined with surgery, which gave good results.[48]

Leitenberg and Zilinskas speculate as to whether the United States shared information with the Soviets regarding the mass production of penicillin using deep fermentation methods or whether Soviet agents obtained the technology by subterfuge.[49] In actual fact, the Soviet government in 1945 is reported to have dispatched delegations to both France and the UK with the aim of purchasing a licence to produce penicillin on an industrial scale. An offer is reported to have been made to pay US$10 million for technology to produce penicillin via the deep fermentation method. It is unclear whether these efforts to procure the technology were successful or not.

What is clear is that, whether based on domestic or Western imported technology, the Soviet Union rapidly created large-scale penicillin production plants in the post-war period. The antibiotic was first produced in three facilities, Moscow Factory No. 40, which employed a method of deep fermentation, the Minsk Penicillin Factory and the Riga Penicillin Factory. The latter came on-stream in 1949.[50] Much of the West's knowledge of Soviet development of its early antibiotics industry came from Nikolai Mikhailovich Borodin, who, in August 1948, defected to the United Kingdom.[51] He was the director of the All-Union Scientific-Research Institute of Penicillin and Other Antibiotics in Moscow, which employed 500 personnel. Borodin was debriefed under the codename *Wildcat*. By 1952, the Soviet Union had established an antibiotics industry manufacturing a range of antibiotics. A total of eight factories alone had been identified as producing penicillin. In the light of the Soviet success with regard to microbial production, fears are reported to have grown in the West that the USSR might redirect its focus on to the mass cultivation of pathogenic bacteria.[52]

The large-scale transfer of antibiotics technologies to China

A major beneficiary of the antibiotics manufacturing technology developed by the Soviet military was the People's Republic of China. The cooperation on antibiotics took place under the terms of the 14 February 1950 Sino-Soviet Treaty of Friendship, Alliance and Mutual Assistance.[53] This was to lead during the ensuing decade to a quite extraordinary effort at collaboration, with the Soviets providing advice and training in areas ranging from defence-related industries and the development of fossil fuels, to the press and curriculum development within universities. Critical input was also provided with regard to the creation of the PRC's pharmaceutical industry.[54] During the period 1949 through to 1960, some 9,000 to 15,000 Soviet specialists and advisers were despatched to China. Some Chinese specialists estimate that this number could have exceeded 20,000. The advisers were posted as consultants at ministries and departments and the Academy of Sciences.[55] It is estimated that, during a ten-year period, some 24,000 sets of design and technical documents were transferred to China. The Chinese historian Chen Xi has described this as the 'the biggest and most comprehensive transfer of technologies, which had no analogues in modern history'.[56] There were also 'vast cultural, educational and industrial exchanges that brought thousands of Chinese students and professors to the Soviet Union, and numerous advisers and specialists from the Soviet Union to China'.[57]

In November 1952, an agreement was reached in Moscow concerning the programme for Soviet aid during China's First Five Year Plan (1953–

7). Under the terms of the agreement, the USSR pledged to provide economic and technical aid in the construction or reconstruction of some ninety-one enterprises, in addition to the fifty begun in the 1950–2 period.[58] Another fifteen projects were added during Khrushchev's 1954 visit, making 156 projects in total.[59]

One of the key projects in China's First Five Year Plan was the development of antibiotics production within the country. The Soviet Union provided a range of critical technological assistance to the Chinese programme. As early as 1956, Soviet specialists worked with Professor Lieh-wei-t'o-fu at the Chinese Academy of Medical Sciences on the synthesis of penicillin. The most important source of technology was the USSR's All-Union Scientific-Research Institute of Antibiotics (VNIIA) in Moscow, which itself had only been in existence since 1947 and had begun the industrial production of streptomycin–using technology originating in the Soviet military—during the period 1949 to 1950.[60] The USSR Ministry of the Medical Industry's State Institute for the Design of Enterprises of the Medical Industry (Gipromedprom) subsequently played a key role in transferring VNIIA production technology for the construction of antibiotics factories in China.[61] The USSR also supplied highly productive strains for the manufacture of streptomycin. In addition, dozens of Chinese specialists focusing on antibiotics received training at a range of Soviet facilities including VNIIA, the Moscow Factory of Medical Preparations No. 2, the N.A. Semashko Moscow Chemical-Pharmaceutical Factory and at the L.A. Tarasevich State Control Institute of Vaccines and Sera.[62]

A massive new project, described as 'one of the focal construction items of China's first Five Year Plan', was launched in Shijiazhuang in June 1953. It embraced an antibiotics plant, a starch factory and a glass factory.[63] The new antibiotics manufacturing facility—projected to be the largest pharmaceutical factory at this time in China and Asia—was initially known as the Medical Factory No. 6—in line with typical Soviet nomenclature for industrial plants of this type.[64] It would be later renamed as the North China Pharmaceutical Factory (Western sources sometimes refer to the facility as the Huabei plant, and in some earlier references by translators using the obsolete Wade–Giles Romanisation as the Hua-pei Pharmaceutical Plant). Initially, the new plant was to be focused on the manufacture of penicillin and streptomycin.

The Soviet Union and the German Democratic Republic are reported to have provided critical assistance in the construction of the Shijiazhuang antibiotics factory, which was one of the 156 Sino-Soviet collaborative projects in critical areas of technology. Soviet specialists and Chinese technicians cooperated closely and are reported to have worked around the clock in order that construction of the facility could proceed rapidly. The USSR supplied all the equipment for the project. It was finished at the end of 1957 and brought fully on stream in June 1958.[65] Its output is reported to have been sufficient to meet China's national requirements for both penicillin and streptomycin.[66] Commenting on the project, one scientist noted that the establishment of the facility 'marked a new phase of grand scale operation and modernization that China's antibiotic industry had entered into'.[67] The Shijiazhuang antibiotics facility subsequently served as a key hub for the development of one of China's most important regional biopharmaceutical clusters.

Military development of bacteriophage preparations: the control of cholera during the Battle of Stalingrad

Against a backdrop of a failing wartime pharmaceutical industry, with shortages of sulpha drugs, soap, disinfectants and other essential drugs, the Soviet military turned its focus to unconventional solutions. During the war, NIIEG launched a programme for the development and manufacture of bacteriophage preparations. Little has been published about this research effort, although the Soviet military scientists drew heavily upon the expertise of the Institute of Microbiology, Epidemiology and Bacteriophage in Tbilisi. This was at the time one of the world's most advanced centres for work focused on bacteriophage. The Kirov institute is reported to have eventually developed technology for the production of bacteriophage, which was successfully utilised for the treatment of gas gangrene.[68] It is interesting to speculate whether the Soviet military went on to further develop defence bacteriophage against other infectious diseases such as anthrax, tularaemia and so on.

The civil bacteriophage researchers in Tbilisi appear to have worked closely with their military counterparts in Kirov and to have made a significant contribution to the war effort. In 1938, the Institute of Bacteriophage had been amalgamated with the Georgian People's Commissariat of Health's Institute of Microbiology and Epidemiology and renamed the Institute of Microbiology, Epidemiology and Bacteriophage. The new facility field-tested its bacteriophage preparations during the 1939 to 1940 conflict with Finland, and phage therapy was employed for the treatment of war wounds during the Second World War. During the war, polyvalent phage preparations were scattered in soil, sewerage and food, as well as given by mouth.[69]

The most dramatic utilisation of phage preparations during the Second World War took place in the summer and autumn of 1942 in the besieged city of Stalingrad. News had reached the Kremlin at this time of a cholera outbreak in the German-occupied part of the city. Georgii Miterev, the people's commissar for health, was charged with preventing the disease infecting Soviet troops and he recommended that the civilian scientist Ermol'eva be granted emergency powers and despatched to Stalingrad. The Soviet scientist had risen to prominence when she published the results of an experiment whereby she had infected herself by drinking a solution of *Vibrio cholerae* and recovered after treatment. Ermol'eva is reported to have reached the besieged city at two o'clock in the morning and to have immediately convened a meeting of an extraordinary commission for combatting cholera. She then set about organising the production of cholera bacteriophage in a specially constructed underground laboratory in Stalingrad. Around 50,000 inhabitants and soldiers were treated in the city every day. Stalin is reported to have used his direct line to converse with Professor Ermol'eva asking her: 'Had the cholera epidemic been defeated? Was it safe to deploy over a million people just outside Stalingrad? Would the epidemic interfere with the army command's plans?'[70] Ermol'eva's success in countering the threat of the cholera outbreak resulted in her being awarded the Order of Lenin in 1942 and the Stalin Prize in 1943.[71] In addition, in recognition of her wartime contribution, Stalin is reported to have personally authorised the release of her first husband, the microbiologist Lev Zilber.[72] After the war, in 1947, Ermol'eva was appointed the director of the newly formed USSR Ministry of Health's Institute of Antibiotics. She later headed the Department of Microbiology at the Central Post-Graduate Medical Institute in Moscow.

12

YESTERDAY TODAY

STALIN'S LEGACY AND RUSSIA'S CURRENT MILITARY BIOLOGICAL NETWORK

Following Stalin's death on 5 March 1953, and the arrest in June of Beria, Petr Nikolaevich Burgasov was temporarily appointed head of the First Department of the newly formed Seventh Directorate of the General Staff of the USSR Ministry of Defence. This directorate now had responsibility for the management of the Soviet BW network.[1] Burgasov's caretaker role did not last long. For the demise of Beria allowed none other than Colonel-General Smirnov (see Chapter 9) to emerge again as the key figure at the head of the Soviet Union's offensive BW programme. Two years after the end of the war, Smirnov had been appointed as the USSR minister of health, and he had held that position until December 1952 or January 1953. He then appears to have been side-lined with an appointment on 28 April 1953 as the head of the USSR Ministry of Defence's Military-Medical Academy in Leningrad. He served in this position through to 26 September 1953.[2] It was sometime around the date of his departure as head of the Military-Medical Academy that Smirnov took charge of the newly formed USSR Ministry of Defence's Seventh Directorate of the General Staff, which was now given responsibility for the Soviet BW programme. Smirnov remained as head of the directorate through to 1955. He then resumed his position as the head of the Main Military-Medical Directorate of the USSR Ministry of Defence. This directorate appears to have headed-up the Soviet BW programme in the period through to November 1960.[3]

Burgasov remained in post under Smirnov until 1958 when he was, at his own request, appointed as a supervisor of studies at the USSR Ministry of Defence's Scientific-Research Institute of Hygiene (Sverdlovsk). Here, he is officially reported to have been engaged in work aimed at the defence of troops and the civil population from biological weapons (botulinum toxins and anthrax). It was during this period that he defended his doctor of sciences' dissertation and was the co-author of a handbook on anthrax and botulinum toxins. Burgasov himself confirms that 'in 1957 and 1958 I was working on antidotes for botulinal toxin'.[4]

In November 1960, Colonel-General Smirnov was appointed head of the newly formed USSR Ministry of Defence's Fifteenth Directorate of the General Staff. The directorate's code name was P/.O. Box A-1968.[5] In his new position, which he retained until 1985, Smirnov became a key decision-maker and ideological driver in the extensive offensive BW programme launched in the early 1970s, which is described in the authoritative account published by Leitenberg and Zilinskas in 2012.[6] He is reported to have been: 'an impassioned advocate of biological weapons. He believed they would dominate the battlefield of the future ... he transformed the programme into a strategic arm of the military and remained a dominating presence in the Soviet biological warfare programme for the next twenty years.'[7] Smirnov is also reported to have believed that 'if your opponent possesses a certain weapon it is the height of folly and imprudence not to equip yourself with it'.[8] In 1975, Smirnov was also appointed to the Interdepartmental Scientific-Technical Council for Molecular Biology and Genetics, which operated under the Main Administration of the Microbiological Industry (Glavmikrobioprom).[9] The council had responsibility for the formulation of new scientific programmes, the coordination of the many different agencies engaged in the BW effort, and the allocation of major sums of hard currency.

Stalin's legacy persisted beyond the Soviet offensive programme. For nearly the entirety of the core infrastructure that was created during his leadership remains in place today. At the heart of Russia's network is the Ministry of Defence's Order of the Red Banner of Labour 33

Central Scientific-Research Experimental Institute (Federal'noe gosudarstvennoe uchrezhdenie 33 tsentral'nyi nauchno-issledovatel'skii ispytatel'nyi ordena institut or 33 TsNIII, Military Unit No. 61469).[10] It is located at the Shikhany proving ground, originally established by Stalin, which has now been declared closed and out of bounds to Western observers by the Russian authorities. On 30 June 1997, the city of Shikhany was transformed by an edict of the then president, Boris Yeltsin, into a Closed Administrative-Territorial Formation (Zakrytye Administrativno-Territorial'nye Obrazovaniya, ZATO), purportedly to ensure the safe operation of the Institute of Organic Synthesis Technology and to maintain the environmental safety of the population.[11] The closed formation encompasses an area of 984.2 hectares, and its borders correspond to the internal perimeter patrolled by Military Unit 61469, which provides security for the Shikhany facilities. Under the terms of the new edict, travel to Shikhany was restricted, and special police, procuracy and courts directly under Moscow's jurisdiction have been reinstalled in the city. The Shikhany facilities were also scheduled to regain special financing from the state budget.[12]

A decree issued by the Russian government in July 2001 confirmed that Shikhany retained its closed status.[13] That there has been no subsequent reduction in security at the site was confirmed in November 2011 when a reporter from Radio Ekho Moskvy visited the town and during his report confirmed that it remained a ZATO. Entrance to the site was only possible with a pass and via three military cordons. He also noted that, with regard to Shikhany and its 6,500 inhabitants, everything, one way or another, remained connected to the 33 TsNIII.[14]

The current Russian military biological network is described and analysed in meticulous detail in the volume by Raymond Zilinskas and Philippe Mauger, *Biosecurity in Putin's Russia*.[15] The three BW facilities created by Stalin at Kirov, Ekaterinburg and Sergiev Posad remain in full operation. Until very recently, the Russian Ministry of Defence's military biological facilities had together formed the Federal State Establishment 48th Central Scientific-Research Institute (Federal'noe gosudarstvennoe uchrezhdenie '48 tsentralnyi nauchno-issledovatel'skii institute ministerstva oborony rossiiskom federatsii', abbreviated to FGU 48 TsNII Ministerstva oborony). The institute's headquarters—formerly known as the Scientific-Research Institute of Microbiology or Military Unit No. 23527—was based in Kirov. In April 2011, 48 TsNII was dissolved as a budget centre.[16] There then was a major reorganisation and shift in management to Shikhany, and the three facilities were reported in 2012 to form branches of the Russian Ministry of Defence's 33 TsNIII.[17]

Russia, in addition, continues to operate one of the Stalin-era's key veterinary anthrax vaccine facilities, the Orel' Biofactory. As well as manufacturing a veterinary vaccine against the disease, the Orel' facility also currently produces a human combined STI-1+PA anthrax vaccine, which has been licensed in Russia.[18] There is undoubtedly a requirement for such preparations with the threat of natural anthrax outbreaks resulting from contact with animal burial grounds remaining ever-present. In July 2016, for example, a twelve-year-old boy died and seventy-two other persons were hospitalised in the remote Yamalo-Nenets Autonomous Okrug in Siberia following contact with an anthrax-infected reindeer herd.[19]

As well as having originally created much of Russia's existing physical military biological infrastructure, Stalin's BW programme is also likely to have resulted in the development by the military of technology for the manufacture of a range of new bioweapons. This technology presumably underwent further development during the offensive programme launched in the 1970s by the Soviet Union and was eventually inherited by Russia.

NOTES

INTRODUCTION

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1. ORIGINS

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2. THE CREATION OF A BW PRISON LABORATORY

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63. Production for 1906 stood at: 356,760 cubic centimetres of anti-plague lymph fluid; 169,080 cubic centimetres of anti-plague sera; 100 cubic centimetres of cholera lymph fluid; 12.5 grams of agglutinated cholera sera; and 2.5 grams of agglutinated typhoid sera. *Pervyi v Rossii issledovatel'skii tsentr v oblasti biologii i meditsiny: K 100-letiyu Instituta eksperimental'noi meditsiny 1890–1990*, Leningrad: Nauka, Leningradskoe otdelenie, 1990, pp. 26–7.
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